Volume 10, No. 6 November, 1955

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Putting Land to a Safe and Sustaining Use Through Zoning
. . . W. A. ROWLANDS

Book Reviews: Handbook for Teaching Conservation and Resource Use; Texas Wildlife; Forestry Handbook; Soil and Water Conservation Engineering; Grassland Farming; Soils and Fertilizers in Taiwan; also others.

Thanks . . .

for the air,
and the water,
and the generous earth . . .

for the miracle of seed,
the promise of blossom,
and the nourishment of fruit.

Thanks . . .

for the dawn,
and the pursuing twilight . . .

for rain,
and snow,
and the glory of the ever-changing year.

Thanks . . .

for music,
and art,
and poetry . . .

for commerce,
and industry,
for invention and achievement.

Thanks . . .

for the steeple,
and the town hall . . .

for the dome of authority,
and the pillar of justice.

Thanks . . .

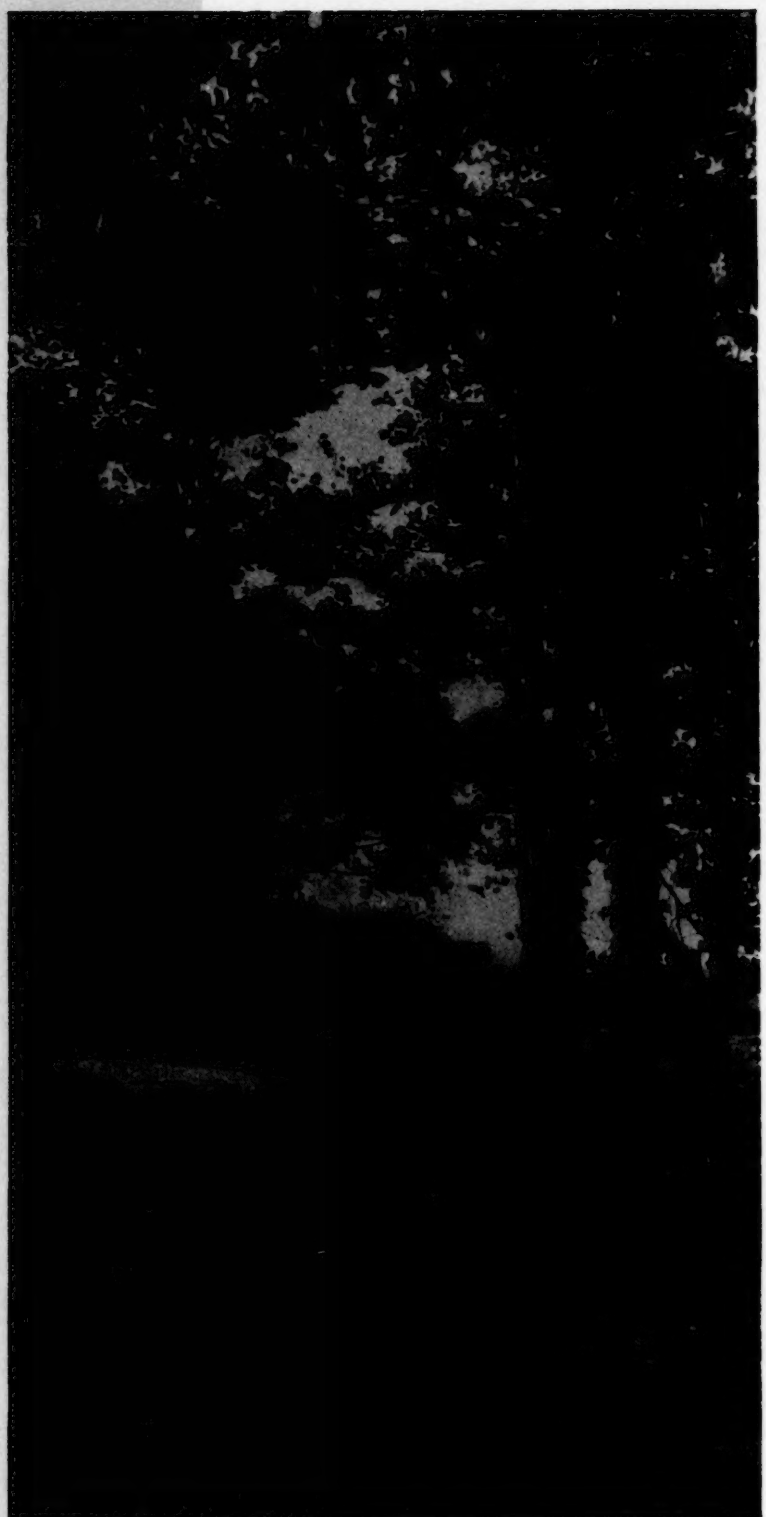
for kin,
for friend,
for neighbor . . .

for the strength of man,
the courage of woman,
for the confidence of the young,
and the wisdom of the old.

Thanks . . .

for the mind to know,
the eyes to behold,
the hands to use,
and the soul to enjoy
all these things . . .

and for the heart to say—
Thanks!



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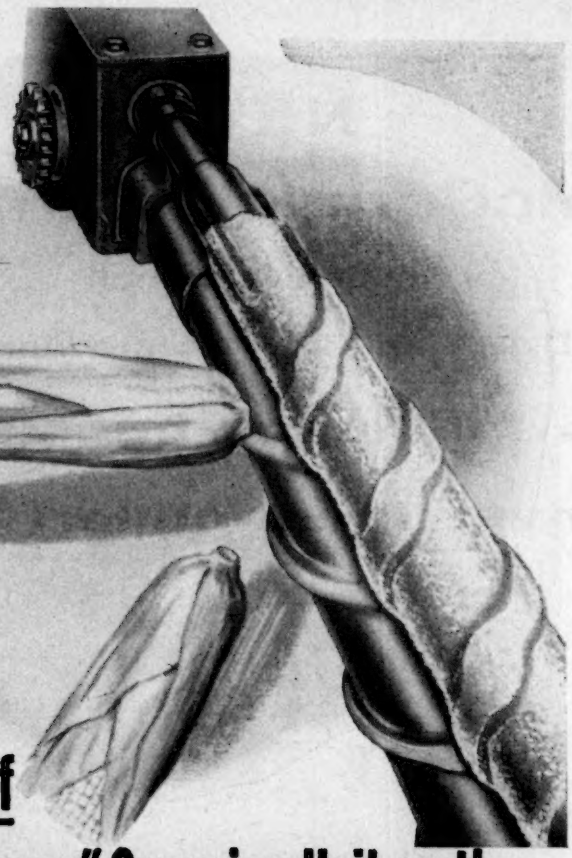

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VOLUME 10
NUMBER 6

Journal of SOIL AND WATER CONSERVATION

TO ADVANCE THE SCIENCE AND ART OF GOOD LAND USE

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***Cover Photo:** A hunter at the end of a day's hunt—returning home with a cock pheasant. Conservation programs throughout the nation improve habitat for wildlife—providing, therefore, excellent hunting for the sportsman.*

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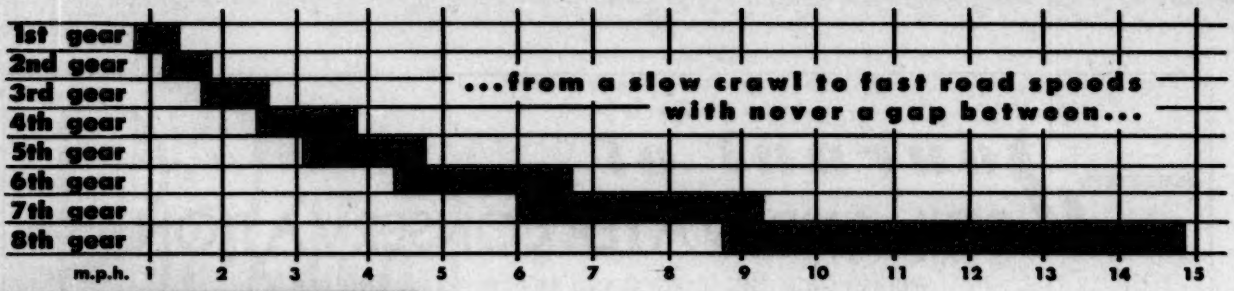
1st gear
2nd gear
3rd gear
4th gear
5th gear
6th gear
7th gear
8th gear
m.p.h. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
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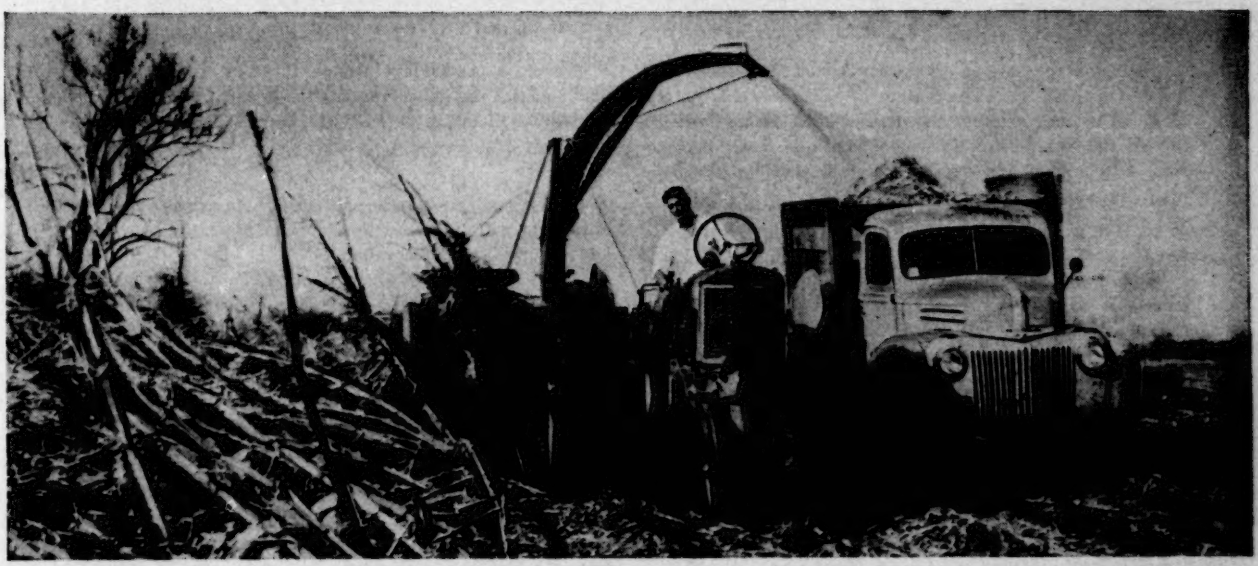

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Philosophy and Objectives
Soil Conservation Society of America

The Soil Conservation Society of America is dedicated to the promotion and advancement of renewable natural resources conservation to the end that water, soil, grass, forests, and wildlife, in abundance, may be used and enjoyed by mankind forever. The Society is founded on the knowledge and belief that these renewable resources are indispensable to the support and growth of strong, prosperous, free nations; that they are interrelated and interdependent — inseparable one from the other; and that their everlasting abundance is dependent on the development, coordination and proficient application of the several arts, sciences, and professions dealing with the promotion of good resource management. Toward the early attainment of this goal, the Soil Conservation Society of America pledges the direction of its energies and facilities.

The objectives of this Society shall be to promote and advance all phases of the science of conservation of soil and water resources; to provide a medium for the exchange of facts, experience, and thoughts; and to represent, advance, and protect the standards of the basic and allied sciences of soil and water conservation. Specifically, this Society will:

1. Champion the several arts, sciences and professions that have to do with the conservation of our renewable natural resources in such a manner as to encourage sound formulation of the best possible system of land and water management within land and water capabilities and the principles of multiple use.

2. Vitalize understanding of the need for conserving our renewable natural resources to the end that conservation becomes an intimate part of the thinking, doing, and living of city and country people alike.

3. Foster more intensive study of the means by which greater skill in the management of land and water can be developed and put into practice as rapidly as possible.

4. Strive for early adoption of high ethical standards on the part of all those who are professionally engaged in the furtherance of improved use of land and water.

5. Work with other conservation agencies and organizations in support of their recognized resolution and purpose.

6. Work for the early adoption of a long-range, country-wide land and water policy as a guide to all agencies, organizations and individuals in their renewable resource conservation activities.

7. Proclaim noteworthy achievements by individuals, agencies and organizations that have assisted in the development of sound concepts and practices in land and water use.

8. Provide a continuing medium for joint consideration of and undertakings in movements designed to foster more effective consideration of renewable natural resources.

9. Publish and encourage publication of constructive literature that will aid in the development of improved concepts and practices in conservation.

10. Work for an enlarged research program designed to contribute toward a better understanding of the means by which more effective conservation methods can be developed and put into practice.

11. Promote rapid development of improved educational programs on conservation in elementary and secondary schools, in colleges and universities, and in adult education fields.

12. Inspire public recognition of the urgent need for a complete country-wide inventory at the earliest possible date so that more rapid progress may be made in getting more land used within its capabilities.

13. Strive for rapid understanding of concepts of the importance of world-wide conservation of renewable natural resources as one of the most important steps toward permanent peace.

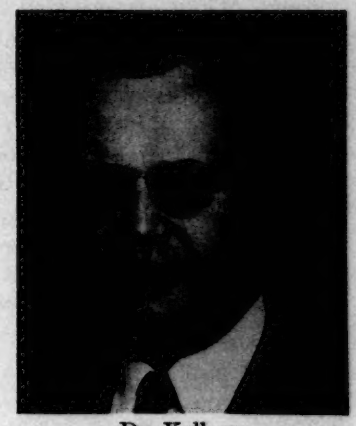
14. Augment the concepts of conservation so they include not only better use of soil, water, grass, forest and wildlife resources in the economy of the world, but aesthetic and human values as well.

Soil Surveys in Modern Farming

CHARLES E. KELLOGG

The primary objective of the Soil Survey is to define kinds of soil in ways that our knowledge about soil behavior and farming systems can be organized and presented to farmers so that they can work out the best combinations of practices for their own fields. In this connection, there are very few soils that have a single "best use." Rather there are many alternative uses and the "best" use depends on the characteristics of the land, and the skill and desires of the operator.

For centuries farming was traditional; now farming in advanced countries is characterized by rapid and drastic change. There will continue to be great opportunities for efficient sustained abundance provided management practices are fitted to the specific kinds of soil.



Dr. Kellogg

FARM PRODUCTION results from management applied to the soil. The total agricultural production in any country reflects the results of millions of decisions made by farm operators dealing with a great variety of kinds of soil. We cannot say that the resulting harvest in any field is due primarily to the soil or primarily to the management.

With changes in the agricultural arts—and the rate of change is now accelerating—the relative productivity of our many kinds of soil changes. That is, the many improvements in the agricultural arts given us by science do not affect all soils evenly; some go up in productivity relative to the others, and some come down relative to the others.

Changes in management also change the emphasis that we need to give specific soil qualities. To illustrate: Until a few years ago great emphasis was placed on naturally fertile soils—those kinds of soil that would give good yields when first plowed and seeded. This quality of soils is less important now than in the past; some of our most valuable farms, in the southeastern part of the country, for example, now have highly productive soils that were exceedingly low in fertility in their natural state. We have good fertilizers at reasonable prices. Now we are much more concerned, relatively, with the physical properties of soils and with the maintenance of optimum moisture within the root zone.

Thus the important knowledge we are now seeking about our soils is their response to management. Farmers produce their arable soils from the natural soils through combinations of management practices. These may make small or great alterations in the natural soil.

For each kind of soil we need to know the several alternative combinations of practices that can be used; the kinds of crops that can be grown and the expected yields; and the long-time effects of the combinations of practices on soil productivity.

I should like to stress the word "alternatives." For very few soils is there any "best" use, in general. Rather there are many alternative uses and the "best" use from among these depends on the other characteristics of the land, such as location and size of unit, and on the skill, resources, and desires of the operator. Thus for each kind of soil several interpretations are needed in farm and ranch planning; and each should be as nearly quantitative as the results of our research and experience make possible.

Kind of Soil

Although the soil that covers the earth is a continuum, we cannot deal with the whole complex and varying continuum at once. We break it up into kinds of soil that we can define in useful terms.

By one "kind of soil" I mean a soil with a unique combination of characteristics that sets it apart from any other kind of soil in the world. The number of characteristics in the combination is exceedingly large, and each characteristic varies in several significant steps.

Thus "a soil" is a specific body or area of one of these kinds. It is a natural body on the surface of the earth. It has shape, area, and depth. At any point within the area a vertical section from the surface, where biological and climatic forces have their maximum influence, down to the limit of biological influences shows the soil to be made up of layers or soil horizons. These horizons may contrast slightly or greatly from another. The whole section is

This paper by Dr. Charles E. Kellogg, a member of the SCSA, was presented at the Tenth Annual Meeting of the Society held at Green Lake, Wisconsin, September 14, 1955. Dr. Kellogg is assistant administrator for Soil Survey, Soil Conservation Service, Washington, D. C.

called a soil profile, which is defined in the terms of the thickness, structure, texture, and other chemical, physical, and biological characteristics of its constituent soil horizons. Within any one kind of soil, probably no two profiles are ever completely identical; but the definition permits them to vary only within defined limits. In soil classification, these limits are set in terms of what we know through soil research about the significance of individual soil characteristics within the various combinations. We are concerned with the significance of these characteristics from two primary points of view: (1) *On the known capabilities and responses to management of the soil; and, more basically, (2) on the genesis of the soil as a function of climate, living matter, relief, parent rock, and time.*

Usually these two sets of considerations go together, but not always. During recent work, and at any time in the past, we have found a few highly significant genetic differences that we had not learned yet to associate with differences in capability or management practices. But the history of soil research shows that the significance of these genetic differences usually appears later. Even today the genetic differences that we cannot interpret in terms of practice can be expected to be important as our research and experience expand. Thus our basic soil descriptions are basic to future interpretations as well as to the present ones.

Like other natural objects, kinds of soil are recognized at various levels of classification. In dealing with the soils of the world as a whole, let us say for comparing the soil potentialities of continents and of great regions, kinds of soil are defined very broadly. For giving specific guidance to individual farm planning, where it is necessary to synthesize all available results of research and experience that influence both soil use and management practices, the kinds of soil are defined within narrow limits—narrow enough for quantitative predictions of the results of alternative farm practices.

Although each kind of soil is a defined combination of a host of characteristics, some pairs of them may vary from one another in few features or even in only one, such as slope, depth of surface soil, or stoniness. Thus within an ordinary county, not having great ranges in relief or climate, all of the soils have many characteristics in common and most of the differences between the several kinds can be related to local differences in the parent rock, in relief, or in the age of the land forms. On the other hand, should we compare the soils of distant places, say those of Maryland with those of eastern Montana, we shall find that the most important differences are those resulting from differences in the native vegetation and climate.

In the detailed soil survey, the kinds of soil are classified as phases of soil types within soil series (1). Those soil areas shown on a soil map that contain 85 per cent or more of one kind of soil are named according to the names of the kinds of soil. Where the pattern of soils is complex, some of the areas shown on the map contain two or more kinds of soil, and such areas are given compound names. Obviously, as the scale of mapping becomes smaller, more of the areas on the soil map have such compound names. The kinds of soil in such compound areas, or soil associations, are usually very contrasting. In other words, a grouping of soils according to the similarity of their characteristics does not usually reduce the complexity of the soil map. To do that, we must define associations or complexes of unlike soils according to their patterns of geographic association.

The local units of soil classification are soil types and phases within soil series. These soil series, named within the nation-wide system, are, in turn, grouped into broader kinds of soil in the higher categories of soil classification. These are soil families, great soil groups, suborders, and orders. Soil areas on small-scale maps of large regions or continents are identified by the names of the groups in the higher categories.

Perhaps I should add here that so much has been learned about soils during the last 20 years, that it is necessary to revise the system of grouping above soil series. This we are now doing in cooperation with our colleagues in soil research and classification in many countries of the world. We hope ultimately to have a world soil map (at a scale of about 1:2,500,000) with a world-wide scientific soil nomenclature. Such a soil map will make possible the useful transfer of the results of research and experience among all countries according to kinds of soil; and we in the United States shall be one of the greatest beneficiaries.

Soil Maps and Their Interpretations

Nothing is more important to an enduring soil survey than a clear distinction between the basic soil survey on the one hand, and the interpretation of the soil survey, on the other. A basic or standard soil survey includes a map showing accurately the boundaries between the kinds of soil, together with precise statements of the combinations of characteristics that define each kind of soil. (Scales of standard soil surveys vary widely according to the need for detail.) Interpretations are made to indicate the capabilities of the soils for use, the adapted crops, estimated yields, opportunities and limitations for various management practices, and the soil qualities that are partly controlled by the current state of the agricultural arts and the current economic outlook. As a soil survey progresses, a descriptive legend for the map gradually expands as data accumulate and finally becomes the completed text for the soil survey report printed with the map.

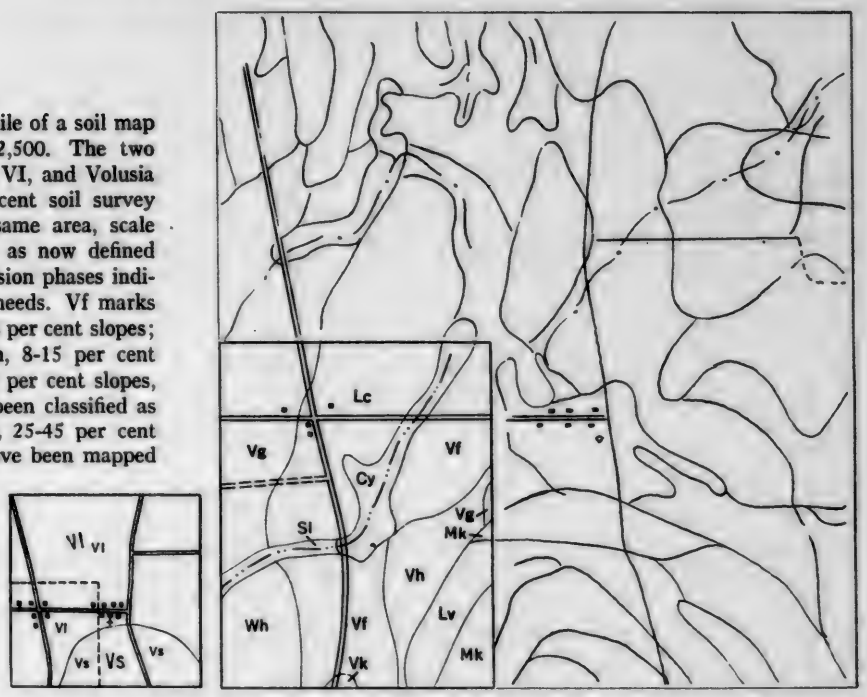


Figure 1. *Left:* One square mile of a soil map published in 1910, scale 1:62,500. The two soils shown are Volusia loam, VI, and Volusia silt loam, Vs. *Right:* The recent soil survey of about one-fourth of the same area, scale 1:20,000. Some Volusia soils as now defined are shown, with slope and erosion phases indicated to meet farm-planning needs. Vf marks Volusia channery silt loam, 3-8 per cent slopes; Vg, 8-15 per cent slopes; Vh, 8-15 per cent slopes, eroded; and Vk, 15-25 per cent slopes, eroded. The steep slope has been classified as Lordstown and Manlius soils, 25-45 per cent slopes, Lv. Chippewa soils have been mapped along part of the drainageway, and steep broken land (Sl) where the intermittent drain flows through a gorge. Areas of Langford, Mardin, and Woostern soils are also shown.

Depending upon the need, numerous specific interpretive groupings can be made. A few examples include productivity according to common use as needed for rural land appraisal for tax assessment; erosion hazard; suitability for crop use after drainage; suitability as highway subgrade; permeability to water; and water storage capacity.

For centuries farming was traditional and conservative; now farming in advanced countries is characterized by rapid and drastic change. I see no letup in the process. Rather I expect to see even greater and more phenomenal opportunities for efficient sustained abundance, *provided* we properly associate our many new combinations of soil, water, and plant management practices with the specific kinds of soil that respond to them.

It is difficult to generalize about soil survey interpretations. Some are relatively permanent; others are relatively ephemeral. We can feel reasonably certain that most kinds of soil now useful for crops will remain so for a long time and that others not suited to crops will remain unsuited to them for a long time. In well-settled countries most soils are fairly well established in one or the other of these two broad divisions, either through scientific procedures or by the simple trial-and-error of farm families, or by some combination of the two methods. In new countries use-capabilities are not well established and drastic changes even in broadly defined uses must be expected with the further development of transport, power, industry, health facilities, and the agricultural arts.

We must continually recall that the soils of the world make up a continuum with gradual transitions from one kind of soil to other strongly contrasting kinds. Even within well-settled countries, some marginal soils between those definitely suited to crops and those not definitely suited are used differently under different local conditions. *I point this out in emphasizing that a properly interpreted accurate soil map is perhaps the more important beginning point for rural land classification basic to land-use adjustments and to rural zoning. Yet schemes for rural zoning, land-use regulations, or crop allotments should include provisions for adjustments with significant changes in the agricultural arts and local economic conditions.*

If we define our soils carefully according to all our present knowledge, and map them accurately, we shall have enduring soil surveys that can be interpreted now and reinterpreted as the years go by. If, on the other hand, we do our interpretation first and show on the map only our interpretations rather than the basic kinds of soil we shall have soil surveys that cannot be reinterpreted with changing conditions. That is, if the definitions of the soil mapping units omit the basic soil features that we decide at the moment are unimportant to practices that we ourselves are unable to explain to farmers, ranchers, engineers, foresters, and gardeners, we shall be unable to use the soil map when the significance of these basic features is understood and practices developed in accordance with them. To have a useful soil map that can be reinterpreted, the whole job must be done over again.

In the past we have had soil surveys that were not interpreted. They were not useful. We have had soil

Estimated average yields per acre of adapted crops under alternative systems of management on the soils of Ontario and Yates Counties, N. Y.

Map Symbol	Soil	Management level[1]	Corn (Silage)	Corn (Grain)	Oats	Wheat	Alfalfa (hay	Clover (hay)	Mixed Legumes (hay)	Potatoes	Field beans	Sweet Corn	Peas (Canning)	Cabbage	Tomatoes
			Tons	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Tons*
An	Arkport fine sandy loam, 0 to 6 per cent slopes	A	10.8	49	49	32	1.6	1.8	1.8	175 s	20	2.5	1615	9.4	7.7
		B	12.0	54	54	35	2.6	2.3	2.2	250 s	23	2.9	1900	13.5	11.0
		C	12.6	57	59	38	2.7	2.4	2.3	312 s	25	3.6	2375	16.9	13.8
Ao	Arkport fine sandy loam, 6 to 12 per cent slopes	A	10.3	46	46	30	1.9	1.9	1.6	140 s	17	2.3	1530	9.0	7.3
		B	11.4	51	51	33	2.5	2.1	2.0	200 s	21	2.7	1800	12.8	10.4
		C	12.0	54	56	35	2.6	2.2	2.1	250 s	23	3.4	2250	16.0	13.0
Hd	Honeoye fine sandy loam, 0 to 3 per cent slopes	A	11.5	52	52	33	3.0	2.8	2.7	210 s	20	2.5	1700	9.8	7.4
		B	12.8	58	58	37	3.0	2.8	2.7	300 s	25	3.1	2000	14.0	10.5
		C	14.1	64	61	37	3.0	2.8	2.7	375 s	28	4.0	2500	17.5	13.1
He	Honeoye fine sandy loam, 3 to 10 per cent slopes	A	11.5	52	52	33	3.0	2.8	2.7	210 s	20	2.5	1700	9.8	7.4
		B	12.8	58	58	37	3.0	2.8	2.7	300 s	25	3.1	2000	14.0	10.5
		C	14.1	64	61	37	3.0	2.8	2.7	375 s	28	4.0	2500	17.5	13.1

[1]Management level "A" is the common management on the majority of the farms of the County; the combination of practices used does not maintain soil fertility, organic matter, and tilth, and prevent excessive erosion. At management level "B" the combination of practices does maintain soil fertility, organic matter, and tilth, and prevent excessive erosion. At management level "C" combinations of management practices exceed those needed for soil maintenance, but some farmers have found these intensive practices profitable under economic conditions prevailing recently.

s—After potato yields indicates potato scab problems.

Capability grouping of soils in Oswego County, N. Y.

Soil Mapping Unit	*Capability Subclass*		*Cabability Subclass*		*Capability Class*	
Alton gravelly loam, 0 to 3 per cent slopes Richard gravelly fine sandy loam, 0 to 3 per cent slopes Sodus gravelly fine sandy loam, 0 to 3 per cent slopes Alton gravelly loam, 3 to 8 per cent slopes Ricard gravelly fine sandy loam, 3 to 8 per cent slopes	I.	Deep, nearly level, well-drained, gravelly soils.			I.	Nearly level, very good soils.
	IIe-1.	Deep, well-drained gently sloping, gravelly soils.				
Sodus gravelly fine sandy loam, 3 to 8 per cent slopes			IIe.	Soils sloping and subject to erosion.	II.	Good soils that require easily applied practices because of gentle slope or some other minor limitation.
Amboy silt loam, 0 to 6 per cent slopes Amboy fine sandy loam, 0 to 6 per cent slopes	IIe-2.	Deep, well drained gently sloping soils on lake-laid sediments.				
Lucas silt loam, 0 to 6 per cent slopes Chagrin loam	IIw-1.	Well-drained, alluvial soils subject to occasional floods.	IIw.	Soils affected by excess water.		
Alton gravelly loam, 8 to 15 per cent slopes Ricard gravelly fine sandy loam, 3 to 8 per cent slopes Sodus gravelly fine sandy loam, 3 to 8 per cent slopes	IIIe-1.	Deep, well-drained, moderately sloping or eroded gravelly soils.	IIIe.	Soils sloping and subject to erosion.		
Gently sloping, hummocky or severely eroded phases of these soils. Scriba gravelly fine sandy loam, 0 to 6 per cent slopes					III.	Soils moderately good for cultivation; slope or other limitations require special practices.
Wallington fine sandy loam, 0 to 6 per cent slopes Wallington silt loam, 0 to 8 per cent slopes	IIIw-1.	Poorly drained "hardpan soils," nearly level or gently sloping.	IIIw.	Soils affected by excess water.		
Westbury gravelly fine sandy loam, 0 to 8 per cent slopes Alton loamy fine sand, 0 to 8 per cent slopes Croghan loamy fine sand, 0 to 8 per cent slopes	IIIs-1.	Deep, droughty, sandy soils on lake-laid deposits, nearly level or gently sloping.	IIIs.	Soils with low moisture holding capacity.		
Ottawa loamy fine sand, 0 to 8 per cent slopes						

Ottawa loamy fine sand, 0 to 8 per cent slopes — fly sloping.

Suitability of Tioga County soils for potatoes

Group and Soils	*Characteristics*
Group 1. Good soils (good climate): Lordstown channery silt loam, gently sloping phase Wooster gravelly silt loam; undulating phase.	Well-drained level to undulating soils of uplands; summers cooler and potato blight less serious than in valleys. Soils acid, with little scab problem. . . .
Group 2. Good soils (fair climate): Chenango silt loam, nearly level phase Chenango gravelly silt loam, nearly level phase Chenango gravelly loam, alluvial-fan phase Howard gravelly silt loam, nearly level phase	Well-drained level to undulating deep soils similar to those of group 1. Slopes less than 8 per cent. Potato scab not a serious problem. Soils acid; . . . these soils occur in valleys where summer days and nights are warmer, fog is more common, and potato blight is a great problem.
Group 3. Fair soils: Bath channery silt loam, sloping phase Braceville gravelly silt loam	Some one or some combination of characteristics makes each soil of this group less well-suited physically to potatoes than the soils of groups 1 and 2. Imperfect drainage, heavy texture. . . .
Group 4. Poor soils: Bath channery silt loam, moderately steep phase Canfield gravelly silt loam: Hilly phase Eroded rolling phase	These are the soils on which mistakes are most commonly made. On some, poor drainage or frequent flooding make crop failures common; on others, hilly topography. . . .

Summary of important characteristics of soil, Grainger County, Tenn.

Soil	Map Symbol	Group According to Legend of Soil Map	Topography	Per cent Slope	Internal Drainage	*Surface Soil* Color	*Surface Soil* Consistence	Thickness inches	*Subsoil* Color	*Subsoil* Consistence	*Subsoil* Texture
Abernathy silt loam	Ab 2	Well-drained soils of the first bottoms or depressions.	Nearly level sinkholes		Free to medium	Brown or dark-brown mellow silt loam to about 30 inches below which the material is generally somewhat mottled.					
Armuchee shaly, silty clay loam: Severely eroded phase	Aco 4	Soils of the hilly, steep and very steep uplands; derived from interbedded limestone and shale.	Hilly	12-30	Slow	Most of the original surface soil washed away.			Reddish yellow	Moderately tough and plastic	Shaly silty clay
Severely eroded steep phase	Acd	Same as Armuchee shaly silty clay loam.	Steep	30-60	Slow	Most of the original surface soil washed away			Reddish yellow	Moderately tough and plastic	Shaly silty clay
Armuchee silt loam	Am	Same as severely eroded steep phase.	Hilly	12-30	Medium to	Dark gray to yellowish gray.	Friable	6	Reddish yellow to brownish yellow	Moderately tough and plastic	Silty clay
Atkins fine sandy loam	Af 3	Poorly drained soils of the first bottoms, depressions, or terraces.	Nearly level		slow	Gray mottled with yellow and brown	Friable	7	Gray mottled with yellow and brown.	Firm but friable	Fine sandy clay loam
Bolton loam	Bl 3	Soils of the undulating and rolling uplands derived from cherty or siliceous limestone.	Hilly	12-30	Very slow	Brown to light reddish brown	Very friable	10	Brownish red or red	Friable	Silty clay
Eroded phase	Blr	Same as Bolton loam.	Hilly	12-30	Free	Reddish brown	Very friable	4-6	Brownish red or red	Firm but permeable	Silty clay

Figure 1. Illustrations of *parts* of four important kinds of soil survey interpretation used in modern soil survey reports.

surveys where the interpretation was done first and important basic features omitted. These cannot be reinterpreted now.

I do not want to belabor these bad experiences. They were part of the learning process. Science moves through a series of approximations. This has been the way we have developed our present soil classification and soil survey techniques. *Yet all of those concerned with the continuity of soil conservation program need to recognize fully the necessity for basic scientific soil surveys that can be interpreted for immediate use and reinterpreted during the long years ahead when farming methods are certain to change again and again as they have in the recent past.*

We must not permit the suggestion that in the soil surveys we have an uneasy choice between two alternative kinds of surveys, one for the scientist and one for the practical man. A soil survey that is not basically sound on the scientific side has little chance of serving the practical users. These users include a large number of very different people. First of all, we think of the needs of farmers and ranchers, and of the people who serve them. But we must also remember the engineer, the forester, the tax assessor, and many others whose work has a great direct or indirect effect on sound land use and soil conservation.

I like to think that we are now developing soil surveys of high standard, both scientifically and practically, based upon our past experiences.

The Soil Survey and the Farmer

The primary objective of the Soil Survey has remained unchanged since its beginning in 1899. This is to define kinds of soil in ways that our knowledge about soil behavior and farming systems, gained through research and experience, can be organized and presented to farmers so that they may work out the optimum combinations of practices for their individual fields and farms. One might even say that our soil conservation program is aimed at putting these soil maps and practices into effect.

Since the Soil Survey began in 1899 we have learned about our soils in this country. In fact, the larger part of what we now know about our soils and their conservation resulted from this work and the other researches it made possible. Techniques of soil study have been enormously improved. Consequently, our present-day standard soil surveys are vastly improved over the earlier ones, especially in precision—precision of definition of kinds of soil, of the boundaries on soil maps, and of our estimates of the effects of combinations of practices on crop yields and soil productivity.

Yet even now, people sometimes ask me, "When will the Soil Survey cease to change its methods and its nomenclature?" The obvious answer is: "When we shall have ceased to learn about soils." As more is learned, the new information must be incorporated into the soil classification and into its interpretations if our basic objective of assistance to farmers is to be reached as effectively as possible.

Then, too, there is no extensive mapping of land areas so complete and so detailed as a modern soil survey. It must be to reach its objectives. Because of its completeness, the results have a great many other important uses to both public agencies and private citizens that must receive our attention.

Soil surveys are made primarily for the use of our farmers, either directly or by those who advise farmers. These users vary exceedingly in their abilities to use and to apply any kind of technical information, including the information collected and related to specific tracts of land through soil surveys. If the soil maps and interpretations are designed for the most advanced users, others will find them too complex to understand; while if the results are simplified into terms clear to those least able to use the results, the soil survey will be presenting less information to most farmers than what they already know about their soils than they already know.

The presentation of the results of such a complicated and technical study as the modern soil survey of an average county is a difficult problem. It always has been; it is now; and it probably always will be. Considering the vast number of specific uses that will be made of soil surveys during the long years ahead, prudence dictates that the basic materials must be published in permanent form. Along with these basic facts must go many kinds of interpretations, each for a specific use and application of the results.

Groupings of the kinds of soil into capability units, and into other special groupings, can be used to reduce the complications. Through such groupings and summary tables showing the dominant characteristics of the soils, the user is provided an introduction to the complexities and to the most highly significant predictions. Such a grouping can be emphasized by special coloring of the map or by a special map extracted from the basic soil map. Normally, however, such special maps are too expensive for the one single purpose they can serve. And we must always be alert to the great hazard of the use of one interpretive soil map for a use that requires a different grouping of the soils. To make maximum effective use of the results of a soil survey, the user must ultimately learn to grasp the details. Thus our problem is to provide introductory grouping without omitting or concealing the significant details.

To complicate the problem of reaching our objective still further, is the ephemeral character of many interpretations, especially those dealing with such specific features of soil management and cropping practices as fertilizer ratios and crop varieties. We are, in fact, in the very

(*Continued on page* 299)

Behavior of Water on the Land

LLOYD L. HARROLD

Consideration of the fundamental relationships of climate, soils, and crops that dictate the behavior of water on the land tend to keep attention focused on major factors of the soil- and water-management problem. Knowledge of behavior of water on the land is fundamental to the formulation of water-management programs.

BEHAVIOR OF WATER on our land may be good or bad—beneficial or destructive—water used or water wasted. In the early days of our national development, little attention was given the behavior of water on the land. The supply was enough for all demands. Floods, although severe, had little effect on the nation or on even the local economy.

The development of our nation's resources, its industry, and urban centers has been phenomenal. In many places the demand for water has exceeded the supply. Likewise, floods have seriously affected the local and national economy. As our development continues in the years to come, water management from the headwaters to the outlet of stream systems will become more imperative. Knowledge of the behavior of water on land is a key factor in the formulation of upstream water-management programs. Where do we get the "know how" for this tremendous planning and evaluation task?

There are only a few locations in the United States where water-behavior and land facts are being gathered. The Coshocton, Ohio Station[1] is one of these.

The results of studies at this station point to fundamental relationships of climate, soils, and crops that dictate the behavior of water on land. These data presented herein are used to illustrate the fundamentals and are not intended to represent firm quantitative evaluations. The period of record is too short and the area studied too small for the latter. These relationships are not new. Some may seem rather elementary. Yet they are important in that they tend to keep attention focused on the major factors of the soil- and water-management problem. Thus, even with very little "on-the-spot" research data, one is less likely to greatly underestimate, greatly overestimate the value of his conservation program, or to overlook the many opportunities of working with nature's ever-changing processes in developing soil- and water-management programs.

The first of nature's processes to be considered is climate and how it affects our conservation program. The next subjects are: (1) the land surface and vegetation along with surface waters, and, (2) the soil profile along with its characteristics of water-absorption, storage, and permeability, and crop use of soil water.

In the humid section of the country perhaps precipitation exerts the greatest influence in the soil and water conservation program. The annual amount of precipitation is known to vary over the twenty-two states of the North Central and Northeastern United States from about twenty inches in northern Minnesota to over forty inches in Virginia. The normal distribution, over the twelve months however, appears to have a noticeable similarity over the entire area—namely, greater monthly amounts falling in the growing season than in the dormant season. It is recognized that this is desirable, as in the growing season crops need more water and then, also, this soil reservoir ordinarily has plenty of space to store this storm rainfall.

Further study of the relationship of precipitation to the conservation program involves a development of an understanding of the different characteristics of the dormant- and growing-season storm precipitation, as follows:

Table 1. Precipitation characteristics

Characteristics	Dormant season	Growing season
1. Form	Solid & Liquid	Liquid
2. Intensity	Low	High
3. Drop size	Small	Large
4. Duration of storm	Long	Short
5. Area of storm	Large	Small

Note: Dormant season in The Ohio River Basin is October-April and growing season May-September.

The effect of these characteristics on erosion resulted in 85 per cent of the annual water-borne soil loss occurring in the May-September period. Observations were made on land fallow for the twelve-month period. The energy of large rain drops falling on bare soil stirs up the soil. High-intensity rainfall causes much surface run-off which transports the soil loosened by raindrops.

In areas where freezing occurs, there is likely to be a period of high erosion when water runs off land slopes having a thin layer of thawed soil on top of frozen soil. Whatever the case may be, conservation technicians and others are encouraged to develop for their own work area a chart of fundamental relationships as that given above.

This paper by Lloyd L. Harrold, a member of the SCSA, was presented at the Tenth Annual Meeting of the Soil Conservation Society of America held at Green Lake, Wisconsin, September 12, 1955. Mr. Harrold is project supervisor, Agricultural Research Service, Coshocton, Ohio.

[1]Operated by U.S.D.A. Agricultural Research Service in cooperation with the Ohio Agricultural Experiment Station, Wooster, Ohio.

Figure 1. Summer floods on small watersheds.

As the technician and the farm cooperator start with these fundamentals firmly established in mind, the field problems will become more readily apparent and more substantial farm-management programs achieved.

While on the subject of precipitation, it is well to discuss its relationship to floods. The Ohio River Basin is used as an example and the question asked "When do floods occur?" The answer invariably is "Winter and Spring." Now let us look at the breakdown of precipitation characteristics for the dormant season as given above and ask "Why?" The answer lies in Items 1, 4, and 5. Snow melt along with rainfall is a big factor at times. More often, however, the duration and areal extent of the storm are the major causative factors. A storm of several days soaks the soil, leaving little or no room for water absorption. Continued rainfall, therefore, must run off. Rainfall intensity is usually low (compared to summer rates), and the resultant run-off from watershed fields is at low rates. Flow from watersheds of a few acres or square miles is not excessive—usually well within the stream banks. Since the winter or spring storms cover most of the drainage area of the big watershed, there are thousands of small streams contributing their flow at the same time to the big-river channel and the channel isn't big enough to carry this water.

Winter and spring storms saturate the soil, exhaust the soil storage space, and continued rainfall over large areas cause large river basin floods. Downstream flood-control works are necesary to handle these excessive water flows to minimize their destructive force.

Attention is now directed to the growing-season floods —those that result from very high rainfall rates. Since the areal extent of these storms is limited, the resultant flood area is small as shown in Table 2. For example, on ten-square mile watersheds, 87 per cent of the greatest annual floods occurred in the growing season, whereas only ten per cent occurred in this season on the 10,000-square mile watershed. Figure 1 typifies the flooding from flash summer storms.

Surely this distribution varies from region to region. Yet, the conservationist will be better qualified to discuss and develop flood-control programs when he realizes the basic causes of floods. Summer small-area floods in many areas are severe. In the Ohio region the soil in this season is usually dry enough to provide a good-sized reservoir for water storage. Why not make better use of it? Let's look at the story of Johnson Run near Shenandoah, Iowa:

Area = 1,230 acres

Soil = Marshall silt loam, deep, well drained

What happened:

1. Floods in Shenandoah were frequent and severe.
2. Now every farm in Johnson Run operates under a conservation plan with contour cultivation and 26 miles of level terraces.
3. In June 1947 when nearby streams reached all-time high levels, Johnson Run was 2/3 full.
4. In May 1951 with 2.41 inches of rain in 2½ hours, Johnson Run was ½ full.
5. In May 1950 with 5.11 inches of rain in 24 hours, Johnson Run was well within its banks.

We can also examine the records of a 44-acre watershed at the Coshocton Research Station. Before 1939, one-third of this area was in native hardwoods and the remainder, gullied and abandoned cropland. In 1939 this poor land was reforested to pines. By 1945 they had become fairly well established. The flood record on this watershed is too short to show significance, but it appears that the 10- and 25-year flood peaks may be expected to be reduced about 20 per cent and the 5-year peak about 30 per cent as a result of this reforestation. These

Table 2. Seasonal occurrence of floods in The Ohio River Basin according to watershed size.

Drainage area Sq. Mi.	Maximum annual floods occurring in— May-September Per cent of time	October-April Per cent of time
1	99	1
10	87	13
100	66	34
1,000	26	74
10,000	10	90
100,000	5	95

(From "Floods and the Farmer," Soil Conservation Service, Milwaukee, Wisconsin, July 1951)

are growing-season floods. The results cannot be extrapolated to evaluate the effect of similar land-use changes on a much larger area—say a 44,000 acre area. A different type storm would cause the major floods on the larger area. There are many other factors which make this conversion from small-area to large-area watersheds impractical. We need to learn how to project information obtained on small experimental watersheds up to watersheds of several hundred square miles in size.

The soil and water conservation technician can learn much about his technical job involving water behavior on the land by a study of the Coshocton small-watershed results. These watersheds are only two to three acres in size and are in a single crop in a particular season. We follow a four-year rotation of corn, wheat, and two years of meadow. Results from conservation farming practices are compared with those from the conventional. The May-September 1948 results on 15 per cent sloping land as an example are given below:

Conventional,	total run-off	= 2.86	inches
	peak rate	= 3.90	inches per hour
	soil loss	=23.0	tons per acre
Conservation,	total run-off	= 1.14	inches
	peak rate	= 1.77	inches per hour
	soil loss	= 7.8	tons per acre

These results are gratifying. Reduction in waste of water and soil of the magnitude given above and shown as Figure 2 should be accomplished on many more acres of our nation's farm land. Yet, in research, we have been looking for ways to accomplish even greater reductions of soil and water loss on each acre of land. This goal becomes more apparent when we realize the high value of soil washed off the land. Soil and Water Conservation Research by R. B. Hickok and Helmut Kohnke on the West Lafayette, Indiana watersheds showed that the concentration of nitrates in soil washed off their land of three per cent slope was three times that in soil remaining on the farm field. This ratio for potash was seventeen.

The effect on contouring was (1) to slow down the velocity of run-off water thus increasing the time infiltration opportunity, (2) reducing its cutting force, and (3) reducing the ability of flowing water to carry soil torn loose by raindrops. The effect of mulches has been even more striking. Its conservation job begins where the erosion process starts—raindrops striking bare soil. Along with other conservation research workers, we found that mulch on the surface of corn watersheds reduced the damaging effect of raindrops and almost eliminated erosion and waste of water in run-off. Results for the May-September 1948 period are given below:

Mulch culture on contour,	total runoff	= 0.05	inch
	peak rate	= .17	inch per hour
	soil loss	= .027	ton per acre

Figure 2. Valuable topsoil washed from an eight-acre conventional corn watershed in one storm totaled 100 tons.

Just as we have seen a great change from straight-row farming to contours and contour strip cropping, we are likely to see equally great changes from clean tillage to mulch tillage and from finely-worked seedbeds to a minimum of seedbed preparation. Both of these latter changes are likely to have a significant effect on water behavior on the land. The Soil and Water Conservation Research Branch of Agricultural Research Service, United States Department of Agriculture, is making a concentrated effort to determine how these changes can best be achieved under a variety of different conditions. This is evidence that there is value in these changes and that more should be known about them for widespread application.

So far, we have discussed basic principles of land surface treatment and their influence on water behavior. Next, we take up the soil profile, and its influence on the behavior of water on the land. As an introduction, we will look at the record for the storm of July 28, 1950. Rain of 1.1 inches of water fell on cornland of our conservation watershed in this single storm. Before the storm, measurements indicated that the unused moisture storage in the top seven inches of the Keene silt loam amounted to 2.8 inches of water (storage space: up to saturation). Although this storage space was over twice as great as the amount of the rain, 0.5 inch of this rainfall was wasted in run-off. Erosion totaled two tons per acre. Waste of water and loss of soil should not have occurred. In fact, it did not occur on the mulch corn watershed. Available storage space was used.

There are, however, times when *readily-available* soil storage space is not sufficient to absorb all the storm rainfall, as illustrated by the storm of September 1, 1950. Rain totaled 4.3 inches. Storage space in the top seven inches of soil of 2.8 inches was considered as readily avail-

Figure 3. Sponges typifying dark-colored permeable topsoil and light-colored subsoil of low permeability.

able. Water penetrated to the seven-inch depth rapidly in the area where the soil surface was protected from sealing. When fairly dry, the absorptive capacity of the top-soil is six inches per hour. At the same moisture content, the absorptive capacity of the subsoil is only 0.25 inch per hour. Therefore, it is evident why only that storage space in the topsoil is considered as readily available. Large pores as shown at the top of Figure 3 absorb and transmit water rapidly. Fewer pores of large size in subsoil prevents use of moisture-storage reservoir therein.

With 2.8 inches of storage in seven inches of topsoil, run-off from the 4.3-inch storm would be expected to be about 1.5 inches. For an eroded soil of three-inch depth, storage space might be only 1.2 inches, and resultant run-off 3.1 inches. This is another reason to stop erosion, namely, to retain a good volume of storage space handy to absorb storm rainfall. Now let's raise our sights and shoot for attaining a greater effective depth of topsoil for quick water storage. Why not have 10, 12, or 14 inches of soil depth for rapid storage? At the same moisture content indicated above—2.8 inches of water storage for a seven-inch soil depth—there might be 4.0, 4.8, or 5.6 inches of water storage space for these three soil depths respectively. It is estimated that if the effective depth of topsoil could be increased to provide a readily available soil reservoir space to absorb five inches of storm rainfall, there would be in this region almost no run-off periods in the growing season.

A knowledge of soil-water plant relationships will also help irrigators and others make the best use of our limited water resources in irrigation programs. The irrigator should, for his field and crops, know the following:

1. ***Depth of soil from which the various irrigated crops extract most of their moisture.***
2. ***Amount of water the crop can get from this soil depth while making maximum production.***
3. ***Maximum rates of moisture extraction for the various crops.***
4. ***When to irrigate.***
5. ***Amount of water to be applied to recharge only that soil depth evaluated in No. 1 above.***
6. ***Rate of water application not to exceed the absorption capacity of the soil during period of irrigation.***

Under-irrigation may result in submaximum yields. Over-irrigation may result in leaching of plant food minerals to soil depths below the plant-root depth and storing water in the soil so deep it cannot be effectively used by the crop.

The above illustrates some of the important basic principles of water behavior on the land. Certainly one must expect the quantitative relationships to differ somewhat from region to region and even from field to field. Yet, with these fundamentals firmly established in his thinking, one is equipped to more clearly recognize the problem on each field and to prescribe remedial measures to take care of its soil and water problems. Futhermore, he is better able to estimate the magnitude of these effects in watershed programs. Accelerated research in water behavior on land is vital to this program.

Conservation is fundamentally an ethical problem, resting upon faith in the universal operation of scientific laws and upon respect for the importance of the human individual. It is also an aesthetic problem, requiring sound and harmonious design of our activities and the setting in which we carry on.

—PAUL B. SEARS

Probably the most important job in conservation for the immediate future is to establish the fact in the minds of the general public that man is a part of a complex environment which must be studied, treated, and modified as a whole and not on the basis of isolated projects.

—EUGENE ODUM

Continuous Cultivation— Its Conservation Significance

J. B. PETERSON

The author of this article points out that soil deterioration resulting from erosion, breakdown of structure, and loss of organic matter was accelerated by early tillage practices. His review of experimental data to improve tillage practices reveals that corn, for example, is not hard on the soil. Other factors, he states, show that sweet clover increases corn yields, the placement of lime and fertilizer maintains productivity, legumes benefit organic matter and nitrogen; also, that the mismanagement of land is responsible for soil losses.

A GENERAL CONCEPT in conservation is that soil parent material when left exposed to a natural environment for a long time will develop into a soil profile. Conservationists, with real justification, have emphasized the importance of the top layer of this profile, the surface soil, or the A_1 horizon. The fact that it is almost always present in undisturbed soils indicates that normal *"geological erosion"* does not take place faster than soil building. The A_1 horizon of a given profile, its depth, nature, and quality, especially in regard to such things as granulation, organic matter, and nitrogen content, are functions of the parent material, the topography, the geology, and the climate of the location in question and of time. Nature seems to protect itself, if left alone, and as has been expressed poetically, the soil profile—buffered by natural biologic systems—tends to sink into the earth with the slow and gradual changes of natural erosion.

Early Techniques Conducive to Erosion

Soil deterioration resulting from erosion, breakdown of structure, and loss of organic matter was accelerated by the tillage practices introduced in this country by the European settlers. There is no doubt that early techniques for the culture of corn were soil depleting and conducive to erosion. Excessive working of the land, tillage to control all weeds and even to prepare soil mulches, up and down hill planting and cultivation, the checking of corn and other practices together with inadequate use of minerals to produce healthy plants with protective canopies to intercept the beating action of rain caused serious soil losses from erosion and the deterioration of soil tilth.

There is much in the literature documenting these statements. A comprehensive review will not be attempted. A few examples will suffice to illustrate the point.

An analysis of results at the Agronomy Farm near Ames, Iowa, for example, shows greater losses of organic matter and of nitrogen for those rotations with higher percentage of time devoted to corn (13). Clarion loam with an oats, corn rotation without the addition of manure lost 16 per cent organic matter in 20 years. A 3-year rotation of corn, oats, clover under similar management lost 12 per cent over the same period. The nitrogen loss over the 20-year period for the oats, corn rotation was 21.5 per cent compared with 13.4 per cent for the 3-year rotation.

Comparisons in the Thirties of undisturbed surface soils in Missouri with adjacent surface layers of fields which had been in cultivation since the country was settled (7) show the cultivated soils to have an average of 35 per cent less nitrogen. In the same bulletin the average annual depletion of nitrogen in terms of the original supply was found for a 50-year period to be 1.13 per cent for continuous corn, .92 for continuous wheat, .54 for continuous timothy, .83 for a corn, oats, wheat, clover rotation, and .82 for a corn, oats, wheat, clover, timothy rotation. The rate of loss was greater during the first 25 years of the experiment in all cases except one. The loss in the first 25 years was 2.06 per cent for continuous corn; 1.5 for wheat; .94 for timothy; .83 for a corn, oats, wheat, clover rotation, and 1.49 for a corn, oats, wheat, clover, timothy rotation.

The deterioration of the content of organic matter and of nitrogen in soils under cultivation proceeds more rapidly in the early years following disturbance of the natural condition by man-induced tillage practices and tends to level off in later years. The negative exponential curve shown by Jenny (5) is typical of the results which have been reported.

Organic Matter and Nitrogen Increased by Legume

The effect of crop removal and low fertility is strikingly shown in 34 years of experimentation by the Illinois Station (10). In rotations of corn, corn, oats, wheat on Tama silt at Mt. Morris, Sable silt clay at Aledo, Sable silt clay at Hartsburg, and Muscatine silt loam at Kewanee, the losses of carbon and nitrogen found in the surface soils after 34 years were in general decreased by introducing sweet clover as a catch crop in the small grain. Phosphate added to the plots which contained that legume resulted in even higher amounts of organic matter and nitrogen in the soil and potash in addition to the phosphate produced still higher amounts. The results at the Mt. Morris experimental field are more or less typical. With no soil treatment and with all stover and straw removed, the

This paper by Dr. J. B. Peterson was presented at the Tenth Annual Meeting of the Soil Conservation Society of America held at Green Lake, Wisconsin, September 13, 1955. *Dr. Peterson is head, Department of Agronomy, Purdue University, Lafayette, Indiana.*

amount of carbon after 34 years was 1.6 per cent. Where the sweet clover was introduced into the rotation, the carbon increased to 1.71. Where phosphate was added in addition to the sweet clover the carbon was 1.75. Where potash was added in addition to the phosphate the carbon was 1.9 per cent. The per cent of nitrogen found in these treatments in the same order was respectively 1.6, 1.7, and 1.9. It seems apparent that there was a marked beneficial effect on organic matter and nitrogen from the introduction of the legume. Furthermore, it is possible that the nutritive effect of the phosphate and potash on the legume and on the other crops in the rotation resulted in greater residues with resulting higher levels of organic matter and nitrogen remaining in the soil.

Fifty-five years of corn following corn beginning in 1888 on the Morrow plots at Urbana, Illinois (4), averaged 29 bushels of corn per acre where no manure or residues were applied and where no mineral nutrients were used. The yield of corn under the same treatment over the same period where corn was alternated with oats was 36 bushels. Under the same management and during the same period corn in a corn, oats, clover rotation produced an average of 48 bushels an acre. Comparable plots receiving manure, lime, and phosphate were started in 1904. They averaged 43 bushels an acre of corn for 39 years of continuous corn. The same treatment with the addition of a sweet clover inter-crop over the same period jumped the corn yield to 61 bushels. Under the same conditions and for the same period, a corn, oats, and clover rotation produced corn averaging 66.5 bushels.

At the south farm at Urbana, the average yields from 1939 to 1942 for experimental plots begun in 1903 where crop residues were returned and rock phosphate was used were 85 bushels of corn per acre for a corn, oats, red clover, wheat (red clover inter-crop) rotation, 94 bushels of corn for the first year of corn and 75 bushels of corn for the second year of corn in a corn, corn, oats, red clover rotation and 65 bushels for the first year of corn, 51 bushels for the second, and 50 bushels for the third in a corn, corn, corn, soybeans rotation. Here, as in many similar experiments, the value of the rotation containing a leguminous green manure is apparent. However, it cannot be determined from the experiment why the legume was so beneficial. The benefit could be due to the effect of the legume on organic matter, on soil micro-organisms, on physical properties of the soil, or on the nitrogen supply.

Jordan Experimental Plots Show Significant Results

Surface soil under grass adjacent to plots which had been continuously cultivated in a four-year rotation for 72 years in the Jordan soil fertility plots of the Pennsylvania Agricultural Experiment Station was found to have 68 per cent more nitrogen than the unfertilized rotation plot, 40 per cent more nitrogen than the rotation plot treated with phosphorus and potassium, and 42 per cent more nitrogen than the rotation plot treated with nitrogen, phosphorus, and potassium. Phosphorus and potassium were added at the rate of 48 pounds of P_2O_5 and 100 pounds of K_2O per acre. Nitrogen was added at 48 and 72 pounds of nitrogen from nitrate of soda. Treatments were made to the corn and the wheat in the four-year rotation of corn, oats, wheat, and mixed hay (17).

In the Marshall silt loam at the Clarinda Soil Erosion Experiment Station, organic matter content consistently declined during a twelve-year period of continuous corn, but remained almost constant during the same time under corn, oats, and meadow (6).

Other studies (15) of the same experimental plots revealed aggregation to be approximately twice as high under the corn plots of a corn, oats, meadow rotation as under continuous corn. Aggregation was also found to drop rapidly when continuous corn followed sod crops and to increase when a rotation was introduced in land that had been previously cropped to continuous corn. Changing from continuous corn to a corn, oats, meadow rotation decreased soil and water losses. Four years of continuous corn following old stands of alfalfa or bluegrass resulted in sharp increases in soil and water losses.

A study of the effect of management on soil permeability was made in Illinois (16). Soils studied included Drummer silty clay loam and Flanagan silt loam representative of the deep, productive dark-colored soils of central and north-central Illinois; Elliott silt loam, a productive dark-colored soil in the plastic till area of northeastern Illinois; Memphis silt loam, a light-colored, well drained timber soil commonly found in southern Illinois adjacent to the Mississippi and Ohio Rivers; Cisne silt loam, a clay pan soil common to the nearly level (gray-prairie) areas of southern Illinois; Grantsburg silt loam, a rolling timber soil having a silt pan and found in the unglaciated section of southern Illinois. The addition of limestone and fertilizers increased the permeability rate of the soil. This response was attributed to increased plant growth. The percentage aggregates in the surface soil of cultivated areas was reduced from four to 20 times as compared to virgin areas. Surface samples of virgin soils compared to plots farmed to corn, oats, clover, wheat (clover inter-crop) rotation were found to be 16 times more permeable and to hold 17 per cent more available water than samples taken from plots farmed to corn, corn, corn, soybeans. Studies of mulches revealed that wheat straw and other crop residues increased infiltration rates approximately three times.

In Texas a comparison was made of characteristics of soil profiles on virgin soils and on adjacent land which had

been cultivated from 50 to 100 years. Houston black clay and Bell clay were studied (9). The Bell clay showed little difference in organic matter and nitrogen content between the virgin soil and the cultivated. The Houston black clay, however, had lost almost 80 per cent of its organic matter from the surface soil through long cultivation. Cultivation reduced the air space in both soils and reduced the pores which would be drained by 30 centimeters of water tension.

However, in recent years there has been a growing body of evidence that where properly handled under certain situations, corn could be grown several more years successively without notable decrease in yield than was possible in the older low fertility systems.

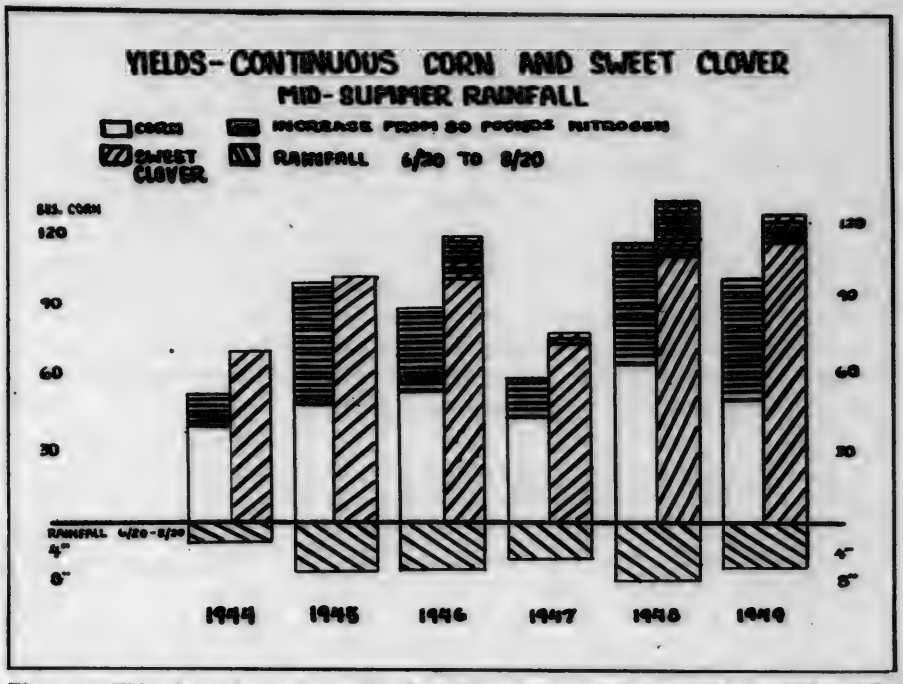


Figure 1. This chart shows the result of continuous corn and sweet clover yields at the Purdue Agricultural Experiment Station.

Use of Sweet Clover Increases Corn Yields

My attention was brought most definitely to the evidence which was beginning to appear indicating possibilities of high corn yields without rotations or leguminous green manures when Professor R. R. Mulvey of the Purdue Agricultural Experiment Station showed me the results of 30 years of rotation experiments in which continuous corn averaged 105 bushels per acre with adequate nitrogen fertilization during the four of the last six years of the experiment in which the June 20 to August 20 rainfall was greater than six inches (2). Up to the last six years of the experiment, this corn did not have nitrogen added as fertilizer and averaged only 49 bushels an acre. The results of this experiment are seen in Figure 1. Continuous corn with 80 pounds of nitrogen are compared with the yield of corn in a corn, oats rotation where sweet clover was used as an inter-crop. The results are shown in the bars in Figure 1. In five of the six years, larger corn yields were produced folowing the sweet clover inter-crop without fertilizer nitrogen than from 80 pounds of fertilizer nitrogen with corn stalks. In the driest summer (1944) the yield difference in favor of sweet clover was 18 bushels. Annual fertilization previous to 1944 on both the continuous corn and corn after sweet clover was 200 pounds of 0-12-12 per acre. When the plots were split and nitrogen added to the treatment in 1944, the phosphate and potash applications in the nitrogen-treated plots were increased to 400 pounds of 0-12-12 per acre per year.

Corn yields after a sweet clover inter-crop in the corn, oats, sweet clover inter-crop rotation were nine and 18 bushels higher following the two drier summer seasons (1944 and 1947) than the yields from 80 pounds of nitrogen and continuous corn. In 1948, with eight inches of rain during the "critical" two months, 160 pounds of fertilizer nitrogen on continuous corn produced 17 bushels more corn (119 bu.) than the sweet clover inter-crop (102 bu.) and as much corn as the combination of 80 pounds of fertilizer nitrogen and sweet clover (122 bu.). Comparisons of the cash returns to be expected from the two systems revealed an approximate $70 loss per year each time the land was planted to oats. This high cost of taking the land out of corn for a year in order to establish a legume green manure impressed on us the necessity of carefully reviewing recommendations for land use. Our main consideration in generalizing from these data has been to evaluate the limitations of the conditions which confine this particular set of results. We are wondering just what the conditions are under which a farmer in the Corn Belt can expect to grow 100 bushels of corn after 30 years of continuous corn.

Corn Is not "Hard" on Soil

Melstead (17) of the University of Illinois, writing under the title of *"King Corn—Soil Builder or Destroyer?"* concludes that there is nothing inherent in the corn plant to make it "hard" on the soil. The harmful action of corn on soils is attributed to inadequate fertilization

and excessive cultivation. He says that when properly managed and adequately fertilized the corn crop may even be the farmer's most profitable soil building crop. He says that the main reason for the "black eye" which corn has is the type of management used in the past on the few experimental continuous corn plots in the country and on the continuous corn rotations on farms. He points out that both experimenters and farmers using rotation practices exploitive to agriculture have, in general, in the past not used enough fertilizer. Under the "no fertilizer" program organic matter in many midwest dark colored prairie soils decreased rapidly and the soils eroded badly. The physical condition of soils became poorer, a deterioration in physical condition paralleling the reduction in yield.

In most experiments on the effect of the type of cropping pattern on soil productivity the basis of comparison was a rotation including a legume green manure in contrast to continuous corn. There was a tendency to attribute most of the evil effect of the continuous cultivation to deterioration in physical condition while overlooking the significance of the nitrogen effect of the legume. Melstead points out that such comparisons lead to the conclusion that the differences in yield were due to the rotation of crops. The unfertilized continuous corn was held up as "the horrible example of what happens if crops are not rotated."

Melstead calls attention to the fact that a 100 bushel corn crop requires 150 pounds of nitrogen, 55 pounds of phosphoric acid, and 95 pounds of potassium oxide.

Melstead believes the problem of growing legumes for soil improvement narrows down to one of choice between commercial nitrogen and the use of a legume as a source of nitrogen. He thinks the commercial nitrogen can substitute for the growth of the legume. However, he points out that management and cultural practices for growing corn must be modified. He says that cultivation should be reduced to a minimum, pointing out that the real reason why farmers tend to work the land excessively is because they have noted increases in yield with additional stirring of the soil. Melstead believes that the excessive cultivation of land to gain these few extra bushels is exploitive.

He points out that soil organic matter can not be maintained if more nitrogen is removed in crops than is returned in residues and fertilizers. He also calls attention to experiments which show that if nitrogen is added to straw or stover residues as they are returned to the soil, those residues can form as much soil organic matter as the nitrogenous residues of legumes.

He cites a five year experiment on a Flanagan silt loam which had been planted to corn and soybeans for 30 years where soil organic matter was increased with continuous corn, managed without plowing and with minimum cultivation but with adequate fertilization. On this soil, corn averaged 92 bushels per acre. Under conventional management this soil lost some organic matter, but yielded 100 bushels per acre. The corn, oat (sweet clover inter-crop) rotation with extra nitrogen but conventional management lost soil organic matter while yielding 111 bushels of corn per acre.

In the same rotation, when the soil was plowed once and the corn cultivated only once, soil organic matter increased and 94 bushels per acre were secured.

Melstead calls attention to the quantity of crop residue which can be returned under different systems of management. Continuous corn at a 100-bushel level with conventional management will return three tons of residue yearly. A corn, oat (sweet clover intercrop) rotation will return about two and one-half tons annually. Continuous corn with an inter-crop will supply an annual return of four tons.

Organic Matter Dependent on Residues Returned

He summarizes that the rate of soil organic matter buildup will depend on the amount of residues returned, the amount of nitrogen supplied with the residues and the tillages practices used.

He reports that after five years of continuous corn there were no significant differences in physical properties of the soil when compared to the soil in legume rotations.

Writing more formally for volume VI of *"Advances in Agronomy"* Melstead (12) cites data by Miller of the Illinois Experiment Station showing that 80 to 100 pounds of nitrogen per acre per rotation would give increases for corn almost equal to those obtained with a corn, corn, oats (legume catch), wheat (legume catch) rotation. He also refers to studies by Kurtz et al. showing 124 bushels of corn per acre in the third year of continuous corn with adequate nitrogen fertilization but without irrigation and 137 bushels for the same treatment with irrigation.

With 200 pounds of nitrogen Barber (3) secured 114 bushels of corn in the second year of corn in new rotation experiments in the 1954 season.

In Missouri (14) yields of more than 100 bushels an acre each year were secured from experimental plots where corn was grown continuously for a four year period on Putnam silt loam. This is a soil type where yields are usually about 40 bushels an acre and where the usual land use recommendations did not include corn except for one year after legumes. In discussing these results Smith (14) emphasizes the need for adequate fertilization, especially with nitrogen and thick planting. He believes that there is no crop in the middle west which will produce the amount of residual organic matter and at the same time a crop for harvest as will well fertilized, thickly-planted corn.

Smith (14) reports data showing an increase in corn stover from approximately 4,000 pounds an acre (15 per cent moisture) with 50 pounds of nitrogen and 8,000

250 pounds of nitrogen and a population of 18,000 plants an acre. He says that the denser population possible with heavy fertilizaton not only increases yields and increases the quantity of organic matter but also reduces erosion. The use of adequate nitrogen hastens early growth, shortening the period in which the corn field is left unprotected. The increased fertility permits thicker planting of corn and furnishes additional cover. Shredding of from three to four tons of corn stalks per acre to be left on the soil surface in the fall provides additional protection. Corn land is thus left unprotected for a much less period than in the old system of low fertilization, low population and no mulching. In light of these findings Smith recommends that the value of rotations of different lengths compared with continuous cropping systems be re-examined and reconsidered under conditions where crop yields are not hampered by inadequate plant nutrients.

Mismanagement of Land Responsible for Soil Losses

The views expressed by Smith (14) are similar to those of Melstead (11, 12). Smith believes the returns from corn production can support the soil building programs for other crops. He believes methods of management are now possible which will not only produce high yields but will also protect the soil from beating rains. Where crop residues are properly handled and mechanical control measures such as contouring and terracing are used on slopes, he doubts that erosion, even from corn following corn, will be significant. He emphasizes that the corn crop in itself is not conducive to erosion, that mismanagement of land has been responsible for soil losses under corn production in the past, that proper attention to soil fertility will permit Missouri farmers to produce all the corn that is needed for feed in the state and will assist in the rebuilding of depleted soils.

It is obvious to anyone looking over experimental results on continuous corn in this country that this type of culture under the safeguards suggested such as high fertility, especially high nitrogen, dense population, shredding of corn stalks and leaving them as a mulch, growth of a live mulch between the corn rows and other practices has not been tried for very many years. Neither has it been tried under enough conditions to justify much generalizing. The particular soils and climates where such culture is feasible may be quite limited. The results of present experiments, however, are outstanding. Studies of the various techniques which may aid in continuous corn culture are likewise impressive. At the Agronomy Farm at Lafayette, Indiana, Luetkemeier was able to get 110 bushels of corn with a live mulch, or cover crop between the rows, in 40-inch rows with corn at about 14,000 to 15,000 plants per acre. Where the rows were widened to about 60 inches the stands of the cover crops were improved but the corn yield fell to about 100 bushels an acre. Spreading the corn rows to 80 inches and keeping the population at about 14,000 resulted in 90 bushels of corn and good stands of cover crops between the rows, although not appreciably better than stands in the 60 inch rows. Luetkemeier believes a 60-inch corn row is about the optimum for the growth of a live mulch.

The effectiveness of shredded corn stalks and other trashy litters in reducing erosion has been thoroughly demonstrated. The effects of such mulching on such soil properties as soil moisture and temperature and on soil biology are not so well known. They are being studied at several locations by both state and federal workers.

Placement of Lime and Fertilizer Important

A practice which seems to have promise as a means of maintaining productivity of soils is the placement of fertilizer and lime evenly down to a depth of about 18 or 20 inches in channels some 40 inches apart. The large increase in volume of roots of corn, alfalfa and other plants in these 18 to 20 inch zones where fertilizer is used seems to indicate a way of increasing the depth of the friable, well-granulated humus-bearing surface layer, in other words, a means of increasing the depth of the effective root-feeding zone. This technique is being tried at several locations in Indiana (8). In a dry year when the soil moisture was depleted below the wilting point in the top ten inches of the soil from mid-August to frost, as much as 20 bushels more corn were produced with the deep placement of fertilizer, showing that the technique is effective as a means of creating a deep feeding zone for roots.

In the corn belt corn is a highly profitable crop. The economic advantage of corn encourages farmers to maximize corn production. They want to do this, however, in ways which prevent soil deterioration. A study of relative profits from different rotations has been published by the Agricultural Economics Department of Purdue University (1). Using yields based on rotation trials by the Agronomy Department on Brookston and Crosby soils representative of central Indiana and costs computed at the 1950 price level, these workers found the following average annual net returns per acre for the rotations cited:

Continuous Corn	$58.92
Corn, Corn, Beans, Wheat, Alfalfa	53.06
Corn, Corn, Oats, Meadow	47.24
Corn, Oats, Meadow	38.92
Corn, Oats, Meadow, Meadow	31.66

Thus it can be seen that the rotations normally considered as soil sustaining, the three-year rotation of corn, plants per acre to 7,000 pounds of stover per acre with

(*Continued on page* 302)

State Legislation for Watershed Protection and Flood Prevention

CARL B. BROWN

One of the unexpected developments of 1955 was the extent and scope of state legislation enacted to further the objectives of watershed protection and flood prevention. It is doubtful that anyone a year ago would have forecast that as many as 20 states would enact 37 pieces of legislation in this field in so short a time. Most of this legislation was a direct result of the Watershed Protection and Flood Prevention Act enacted by the 83rd Congress in August 1954.

PRIOR TO 1955 all states had legislation to define and carry out state and local responsibilities in some phase of soil and water resource conservation and development. In the western states, even when they were territories, many laws were enacted to create or permit the formation of local irrigation districts. Each of the 17 western states has adopted some form of code defining property rights in the use of water. Most of these states and many eastern states have legislation vesting in some state agency certain responsibilities for review and approval of plans for construction of dams and other water resource improvements.

In the eastern states, generally after 1900, many drainage district acts were passed and under them thousands of drainage districts were formed. Of even earlier date are special laws chartering or creating districts or companies for canal improvements and authorizing water-power developments.

In a few states acute problems of flood control many years ago led to enabling legislation to permit the formation of local flood control or conservancy districts. Notable among these is the California legislation which created county flood control districts. Outstanding in terms of work accomplished since 1920 is the Los Angeles County Flood Control District.

Another example is the Ohio Conservancy Law, which stemmed from the flood catastrophe on the Miami River, particularly at Dayton, Ohio, in 1913. The Miami Conservancy District was created shortly after its enactment. Later districts with comparatively broad powers were organized under this law. As in the Muskingum Conservancy District, these functions included not only flood control but also related activities such as reforestation and soil conservation.

In still other states, such as Texas, conservancy districts have been created by the state legislature to construct and operate major river improvements in the Colorado and Brazos river watersheds, for example. These include multiple-purpose dams for flood control, power, and water conservation.

Since 1937 the most extensive body of state legislation in a single field has been enacted into law. This comprises the soil conservation district laws prompted by recommendation to the governors of the states by the late President Franklin D. Roosevelt. It took from 1937 to 1945 to complete the enactment of these laws in all states. They are designed primarily to permit the formation of local self-governing districts to promote the control and prevention of soil erosion on a voluntary basis.

From the date of enactment of the last of the soil conservation district laws until after 1950 very little state legislation in the soil and water resource field was considered or enacted. The revival of interest in watershed protection and flood prevention on upstream watersheds in 1951 and 1952 led to introduction of a few pieces of legislation in those years. The first legislation aimed primarily at enabling local people to carry out their own projects of upstream watershed protection and flood prevention were the watershed district laws enacted in Kansas and Nebraska in 1953.

The Watershed Protection and Flood Prevention Act (Public Law 566)

Public Law 566 was a precedent-making Federal statute in the natural resources field. It embodied a new principle of Federal-State-local relationships by placing major responsibility on local organizations for the initiation of watershed protection and flood prevention projects and by making these organizations responsible for carrying out, operating, and maintaining the projects with assistance supplied by the Department of Agriculture. Moreover, it placed a responsibility on the state, or some agency thereof, for reviewing all projects initiated by local organizations and planned with the aid of Federal agencies.

Enactment of this legislation found many states ill-prepared to assume the responsibility that it contemplated. This situation, however, had not gone unrecognized by leaders in the watershed movement. Many of them, including particularly officers of the national and

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state associations of Soil Conservation districts, took the initiative in fostering legislation to correct these shortcomings during the 1955 sessions of state legislatures. Numerous proposals were made to provide for the assumption of appropriate responsibilities at local and state levels in order to cooperate to the fullest practicable extent with the Federal Government under the terms of Public Law 566.

Authority of Soil Conservation Districts Under Public Law 566

Public Law 566 includes a provision that, "local organizations shall . . . obtain agreements to carry out recommended soil conservation measures and proper farm plans from owners of not less than 50 percentum of the lands situated in the drainage area above each retention reservoir." This places a major responsibility on soil conservation districts in watershed treatment. Whereas soil conservation districts now contain about 90 per cent of the agricultural land of the nation, other special-purpose districts that might qualify under the Act probably do not include more than 10 to 20 per cent of the area of the country. It logically followed that the first step needed was to determine whether soil conservation districts qualified as local organizations to initiate and carry out projects under Public Law 566.

The office of the general counsel of the Department of Agriculture took the position that the question of the authority of a local organization "to carry out, operate and maintain" works of improvement as specified in Public Law 566 was a matter for the state attorney general to determine on the basis of state legislation. A majority of the attorneys general have ruled that the intent of soil conservation district legislation was sufficiently broad to qualify districts as local organizations with authority to carry out certain types of watershed protection and flood prevention projects under Public Law 566. Most soil conservation district acts, however, were written to provide specifically only for the prevention and control of soil erosion and any additional authority was either implied or incidental to this primary purpose. In a few states the attorneys general ruled that districts cannot qualify as local organizations under the Federal Act.

For the foregoing reasons it became apparent soon after passage of Public Law 566 that the authority of soil conservation districts in most states should be broadened and strengthened by the enactment of new or amendatory legislation.

One other significant point should be noted. Legal authority is separate and apart from actual ability to carry out, operate, and maintain works of improvement. The latter often, if not usually, involves the power to tax and the power of eminent domain.

Assistance from the Department of Agriculture

This brings us to the situation as it existed at the beginning of 1955.

The Department of Agriculture has purposely refrained from making general recommendations to the states as to what forms of legislation would best meet state and local responsibilities in watershed protection. This has seemed to be a wise course of action in view of the many and varied state constitutional requirements, the kinds of state statutes already in existence, and the differing historical patterns of local action.

The department through the office of the general counsel and the Soil Conservation Service has assisted state-wide organizations, state administrative agencies, study commissions, and legislative committees in understanding the legal requirements of Federal law pertaining to local cooperation. It has explained the policies and procedures established for the administration of the activities authorized by the Federal law. This service will continue to be available to any states desiring it and may be obtained by request to the administrator of the Soil Conservation Service. A digest of the state legislation thus far enacted in 1955 has been prepared by Kirk M. Sandals of the Soil Conservation Service and L. M. Adams of the Office of the General Counsel[1].

The Pattern of State Legislation

Sandals and Adams have divided the legislation enacted this year into five general groups on the basis of the types of agencies established or given responsibilities for watershed projects. *These groups are (1) state agencies, (2) counties, cities, and towns, or similar political subdivisions of the state, (3) soil conservation districts, (4) watershed districts, and (5) other special-purpose districts.*

New state legislation does not follow any geographical pattern with respect to the kinds of authorities and responsibilities created, nor is the legislation concentrated more in one section of the country than in another. The western states of California, Nevada, Wyoming, and Colorado; the plains states of Texas, Oklahoma, Kansas, and Nebraska; the Corn Belt or Upper Mississippi Valley states of Illinois, Iowa, Minnesota, and Wisconsin; the southeastern states of Tennessee, Mississippi, and North Carolina; and the New England and northeastern states of New Hampshire, Vermont, Connecticut, Maryland, and Delaware all enacted new legislation. Thus, the pattern was not in any sense sectional.

State Agencies

Most states for some years have had state agencies in resource conservation such as departments of conservation,

[1] *Progress in State Legislation Relating to the Watershed Protection and Flood Prevention Act*, by Kirk M. Sandals and L. M. Adams. SOIL CONSERVATION SERVICE, U. S. DEPARTMENT OF AGRICULTURE, August 1955.

natural resource boards, water boards, or flood control boards. Moreover, all states have soil conservation committees or similar bodies responsible for promoting and coordinating the activities of soil conservation districts. These state agencies with few exceptions have been concerned solely with such matters as education, information, research, surveys, and such supervisory functions as the approval of specifications for dams and the granting of water use permits. In some states soil conservation committees have been responsible for allocation of state-appropriated funds for assistance in the operation of soil conservation districts.

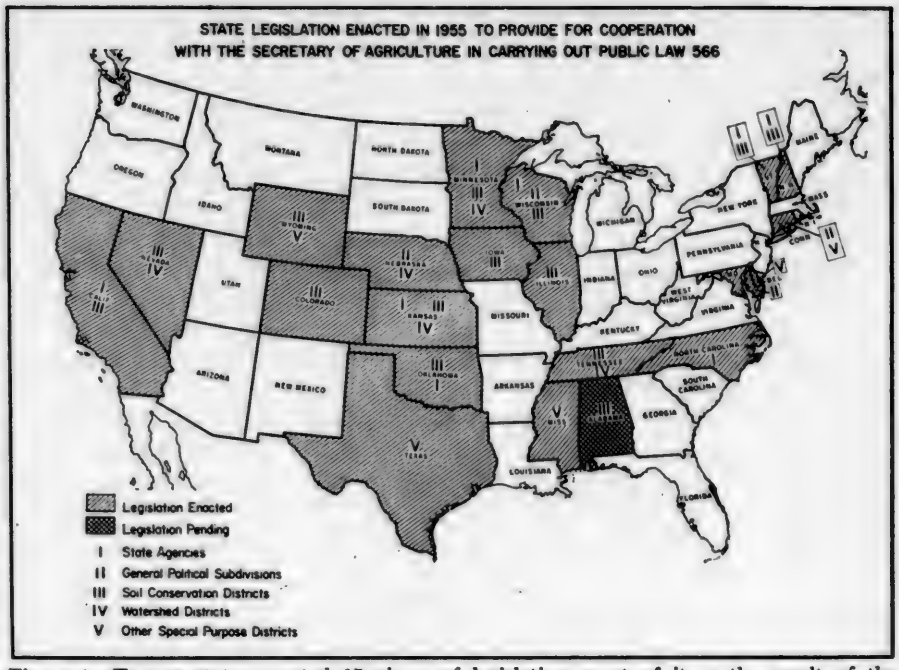
STATE LEGISLATION ENACTED IN 1955 TO PROVIDE FOR COOPERATION
WITH THE SECRETARY OF AGRICULTURE IN CARRYING OUT PUBLIC LAW 566
Legislation Enacted
Legislation Pending
I State Agencies
II General Political Subdivisions
III Soil Conservation Districts
IV Watershed Districts
V Other Special Purpose Districts

Figure 1. Twenty states enacted 37 pieces of legislation, most of it as the result of the Watershed Protection and Flood Prevention Act.

Since August, 1954, state soil conservation committees and a variety of other State agencies have been designated to review applications under Public Law 566 (Figure 2). In only a few cases, however, have State agencies been empowered and provided funds to assist in carrying out projects of the type that are eligible for assistance under Public Law 566. Exceptions include the Water Conservation Commission of North Dakota, the Water Conservation Board of Montana, and the State Department of Public Works of Louisiana. These agencies have broad powers to assist local organizations in both planning and financing contruction of improvements. Also, the State Water Resources Board of California controls state funds that are made available to local organizations for acquiring land, easements, and rights-of-way necessary in connection with flood control and watershed protection projects.

During 1955 eight states enacted legislation creating or enlarging responsibilities of state agencies. Kansas created a Water Resources Board consisting of seven members appointed by the governor. The board is largely a fact-finding and recommending agency concerned with the conservation, development, management, and use of the water resources of the state.

Minnesota created a Water Resources Board composed of three members appointed by the governor. This board has the authority to create watershed districts in the state upon petition of resident freeholders of any county, city, village, or borough for the purpose of conserving the natural resources of the state through land utilization, flood control, and other needed improvements.

North Carolina created a Board of Water Commissioners consisting of seven members appointed by the governor with power (a) to carry out a program of planning, research, and education concerning the conservation and use of water resources; (b) to maintain a general inventory of water resources of the state; and (c) to authorize counties, cities, and towns during water emergencies, after certain requirements are met, to divert such water in the emergency area as is necessary to meet the needs for human consumption and necessary sanitation and public safety.

Vermont amended the powers and duties of its existing Water Conservation Board by empowering it, with approval of the governor, to construct, operate, and maintain dams for water-control purposes and structures for streambank protection or improvement of stream channels. The legislature also appropriated $10,000 for the biennium for initiating action for such purposes.

California broadened the authority of its Water Resources Board by enabling it to grant funds for land, easements, and rights-of-way to local organizations for watershed protection and flood control projects. New Hampshire made a small appropriation to enable its Water Resources Board to assist in carrying out watershed projects. Oklahoma created a study commission on water problems; and Wisconsin directed its joint legislative council to make a study of watershed management.

Counties, Cities, and Towns or Other Political Subdivision of a State

During 1955 four states—Nebraska, Wisconsin, Connecticut, and Maryland—enacted legislation which broadened the powers and duties of one or more types of general political subdivisions.

The new Nebraska legislation authorizes counties (1) to appropriate such funds as are necessary to fully develop and carry out coordinated flood control programs, (2) to make an annual tax levy not to exceed one-fourth mill upon the assessed value of all taxable property in the county for this purpose, and (3) to employ the services of any non-profit corporation or organization that has as its principal objective the promotion or development of flood control within the counties. For example, this third provision would enable the counties to employ a locally-formed watershed association to act as its agent for the purpose of planning and carrying out watershed-protection activities.

The new Wisconsin statute authorizes counties and towns to raise and expend funds to assist in creating and developing watershed protection areas or projects. It authorizes towns to raise and expend funds to assist in developing or promoting the work of soil conservation districts included in or benefiting the towns.

The Maryland law is a local law which authorizes the Board of County Commissioners of Worcester County to carry out, maintain, and operate works of improvement for soil conservation, water conservation, flood prevention, and agricultural phases of the conservation, development, utilization, and disposal of water, including drainage projects. This law was enacted specifically to provide for a local organization having necessary authority to carry out projects under Public Law 566. It is comparable to certain local laws passed in Texas.

The Connecticut law, which will be described later, provides that any municipality may exercise through a flood and erosion control board the powers granted in the general statute to a special-purpose district.

Soil Conservation Districts

The largest number of state laws passed in 1955 were amendments to existing soil conservation district laws. Thirteen states enacted such statutes: California, Nevada, Wyoming, Kansas, Oklahoma, Minnesota, Iowa, Illinois, Wisconsin, Tennessee, Vermont, New Hampshire, and Colorado. Most of these states provided additional statutory authority for soil conservation districts to carry out, operate, and maintain works of improvement for flood prevention and various phases of agricultural water management. In several cases the attorneys general in these states had specifically ruled that districts did not have such authority prior to the amendment of the legislation.

Several of the states went beyond granting authority to the districts for this purpose. For example, Colorado authorized soil conservation districts to levy a tax or assessment on real property in a portion of the district. This requires a favorable vote of the qualified voters in that portion of the district. The funds may be used for the installation, maintenance, and operation of flood prevention and watershed improvement measures and practices within that portion of the district, or in the care, treatment, and operation of lands therein.

California made provision for the formation, in watershed areas, of improvement districts within soil conservation districts.

Illinois and Iowa enacted a distinctly new type of legislation which has attracted much attention. The new Illinois law provides, among other things, that soil conservation districts shall have the power to create subdistricts in a watershed area. Such subdistricts may be within a single soil conservation district or may be created jointly by the action of several soil conservation district governing bodies. The law provides that the governing body of the subdistrict shall be the directors of the soil conservation district or districts in which the subdistrict is formed. It gives the subdistricts power to develop and execute plans and programs for the prevention of erosion, floodwater, and sediment damage. It authorizes the levying of a tax not to exceed one-eighth of one per cent of the value of all taxable property within the subdistrict.

The Iowa law is quite similar although somewhat more restricted. Subdistricts are given the power to levy a special annual tax not to exceed four mills on the assessed valuation of all real property within the subdistrict. The revenue is to be used for the repair, alteration, maintenance, and operation of the works of improvement of the subdistrict. The Iowa law does not provide authority for raising funds to participate in the installation of works of improvement.

Oklahoma amended its soil conservation district laws to authorize districts to acquire lands, easements, and rights-of-way by exercising the power of eminent domain.

Watershed Districts

Watershed districts are a type of special-purpose district created to meet the need for a local organization to carry out, operate, and maintain a watershed project. The first watershed district laws in the nation were enacted in 1953 by Kansas and Nebraska. However, other types of special-purpose district laws of earlier date provided for many of the functions usually associated with a watershed project.

During 1955, Nevada, Tennessee, and Minnesota passed legislation to permit the creation of watershed districts; Kansas and Nebraska amended their existing legislation mainly in the interest of simplification. The

(*Continued on page 292*)

Endersbee

Nunn

Sauer

Wilson

Your Fellow and Hono

Four individuals were elected as Fellow Members of the Soil Conservation Society of America and so honored at the 1955 Annual Meeting held at Green Lake, Wisconsin. This recognition goes to members professionally engaged in practicing, investigating or teaching soil and water conservation.

FELLOWS

William J. Endersbee, Washington, D. C. Mr. Endersbee is a past-chairman of the District of Columbia Chapter of the Soil Conservation Society of America . . . a charter member. He has had a long and varied experience in the field of resource development throughout the United States and its territories. He is a Forestry graduate of Syracuse University and participated in the first land classification surveys made by the government in 1916-17 . . . the forerunner of the present-day land use classification system. Mr. Endersbee has done outstanding work in white pine blister rust . . . has taught at the university level, worked as supervisor of the Civilian Conservation Corps program in the eastern states, Alaska, Hawaii, Puerto Rico and the Virgin Islands . . . organized the soil and moisture conservation program in the Indian Service and was its director for five years. He is staff specialist for conservation in the Secretary's office . . . currently responsible for recommending conservation policies and procedures for the improvement and protection of the public and Indian lands administered by the Department of the Interior. His record in establishing cooperative working relations with Federal, state and private conservation agencies is outstanding.

Alexander Nunn, Loachapoka, Alabama. Through the keeness of his mind, his insight into the habits and customs of farm people, and the warmth of his approach to their problems, Mr. Nunn, an editor for *The Progressive Farmer,* is one of the South's most outstanding exponents of improved practices in soil and water conservation. His columns are open to all those who have something worthwhile to say about conservation . . . his readers know the material is faithfully, honestly and courageously presented. Mr. Nunn, recognized as a community leader, has often been called to Washington to advise with congressional and departmental committees on agricultural matters; his counsel is considered wise and sound. He is an active churchman also, with a family devoted to widespread community activities. Mr. Nunn is active in the Soil Conservation Society of America and has appeared on two of its annual meeting programs with distinction.

Elmer L. Sauer, Urbana, Illinois. As an agricultural economist in the Production Economics Research Branch of the Agricultural Research Service with headquarters at the University of Illinois, Mr. Sauer has had the opportunity to contribute greatly to research leading to the conclusions that soil conservation farming pays satisfactory dividends. A charter member of the Soil Conservation Society of America, Mr. Sauer often contributes to the JOURNAL and is especially helpful as a reviewer of books and other publications. It is as a writer, perhaps, that he has made his greatest contributions to present-day knowledge and practices in the field of soil and water conservation . . . his list as an author or co-author is long and impressive. His articles have had a profound effect on the thinking of officials, professors, students and the public at large. He holds a Doctor's degree from the University of Illinois in agricultural economics and is considered to be an authority in that field. He has a number of outside interests, however, which takes him away from his research field . . . giving him breadth of understanding which otherwise would not have been possible. As a Charter member of the Soil Conservation Society of America, he has served on many of its committees, is at present a member of the Council and the Editorial Board of the JOURNAL.

Chester S. Wilson, Stillwater, Minnesota. As an outstanding exponent of the complete conservation program embracing soil, water, woodland and wildlife conservation, Mr. Wilson was, until recently, commissioner of conservation for the State of Minnesota. He is a recognized leader in promoting soil conservation districts, watershed projects, securing Federal and state appropriations, cooperating with the Soil Conservation Service, Extension Service, conservation education, and other groups and programs. His training as an attorney at the University of Minnesota Law School helped him to understand many aspects of the conservation legislative program not apparent to many of his co-workers, made him invaluable on many committees shaping such programs. Mr. Wilson has held membership on many committees and in many associations, including the Soil Conservation Society of America. He is a member of the National Council . . . maintains offices in St. Paul, Minnesota, but is a resident of Stillwater. He was born there, is a veteran of the Mexican expedition and World War I, and an outstanding leader in his community.

HONORARY

Noble W. Clark, Madison, Wisconsin. Associate director of the University of Wisconsin Agricultural Experiment Station, Mr Clark has been a member of the staff there more than 30 years. During this period he has become a national figure in soil erosion control and related phases of conservation activities . . . serving as consultant to state and national individuals and groups in pro-

Clark

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orary Members for 1955

Honorary Membership in the Soil Conservation Society of America—for outstanding contributions in the field of soil and water conservation—was granted to five individuals.

gram planning and project initiation and management. He also has found time to author publications dealing with erosion control, stressing farmer-government cooperation and sound planning. He belongs to many committees and organizations devoted to conservation study and promotion . . . is a graduate of the University of Wisconsin and has studied in other universities. His wise counsel is sought in Washington and other places where erosion control is a vital subject. Mr. Clark helped to direct the activities of the old Civilian Conservation Corps during the depression years into soil conservation channels . . . which later came to the attention of government officials through this outstanding contribution to the nation's recovery.

J. B. Douthit, Pendleton, South Carolina. Currently chairman of the Agricultural Committee of Clemson Agricultural College, of which he is an alumnus, Mr. Douthit is perhaps best known in the South for his many contributions to a sound soil and water conservation policy. He is the oldest conservation district worker in the nation in point of service. Following graduation from college, he returned to his home farm, where he has since resided. His program of soil and water conservation on the *"home farm"* has outstanding quality and has served as a model demonstration. In espousing the cause of better conservation, he attends many meetings outside his home community . . . and as a church leader, he finds other opportunities to tell the story of conservation as one of the underlying foundation stones to a better life. His contributions to rural life have been recognized in many ways such as election to offices, resolutions of commendation and respect from many groups, and by having had conferred on him the degree of Doctor of Agriculture by his Alma Mater last year

Reverend Msgr. George J. Hildner, Villa Ridge, Missouri. Often referred to affectionately as the *"Saviour of Soils and Souls,"* Msgr. Hildner was honored in May of this year when he marked the golden anniversary of his entry into the priesthood, through which office he has been a powerful missionary in the cause of soil conservation. From the time he helped to organize the first soil conservation district in Illinois in 1937, he has crusaded for better soil conservation practices, improved crop rotation and adequate protection against erosion and other soil depleting practices. His greatest work has been in the field of soil conservation, perhaps his outstanding achievement being the organization of the Missouri State Association of Soil Conservation District Supervisors, of which he is secretary-treasurer. He is a pioneer member of the Soil Conservation Society of America, active in its work, has been honored by many groups for his unusual contribution to the general cause of a better living from the soil. People from all over the Nation went to his home county to honor him on his golden jubilee anniversary.

William H. Kircher, St. Paul, Minnesota. One of the Midwest's outstanding exponents of conservation, Mr. Kircher is managing editor of *The Farmer*, a regional farm magazine published at St. Paul. He is a native of Quincy, Illinois, studied at the University of Missouri, and became a reporter on his home-town newspaper, moving up to night editor and later entering the farm field as editor of an agricultural page on the Decatur, Illinois, *Herald.* Early during 1930 he became field editor of *The Farmer* of which he has been managing editor since 1952. Mr. Kircher writes candidly and searchingly on many farm subjects, but he is at his best in the field of conservation. He is the author of numerous articles on the conservation of soil and water resources. Aside from his writings, he is often called on to speak on conservation subjects . . . an active worker in the Minnesota Chapter of the Soil Conservation Society of America, acting as temporary chairman during the period of its organization. Mr. Kircher has traveled abroad on government assignments and is much sought after for his wise advice and counsel.

Emil Truog, Madison Wisconsin. Dr. Truog has literally devoted his lifetime to the study of soils and to teaching about them. For almost a half century as a professor of soils at the University of Wisconsin, he taught continuously and did much writing, his articles appearing in numerous scientific and semi-popular journals and bulletins. Fifty students have taken Ph.D degrees since 1920 under his teaching. Most of his articles have been on the subjects of soil testing for lime and fertilizer needs, methods of fertilizer applications, availability of plant nutrients, and associated fields. The famous Truog test for lime was developed by him. Following his graduation in 1909 at Wisconsin with a B.S. degree, he was employed there as an assistant in Soils. He received his Master's degree in 1912, also from Wisconsin, and remained on the faculty. He has reached retirment age, but continues to be active in the affairs of the Soils Department. His article, *"Soil Fertility: A Factor in Conservation,"* is recognized as an outstanding contribution to soil and water conservation literature. He belongs to many scientific societies and is a past president of the American Society of Agronomy.

(*Continued from page* 289)

Nevada statute provides for the creation of watershed protection and flood prevention districts upon petition to the Board of County Commissioners. It provides that each district shall be governed by a board of three directors appointed by the Board of County Commissioners. It gives such districts the power to levy special taxes, through the Board of County Commissioners, for necessary district administrative expenses.

The Tennessee statute is based largely on earlier drainage district acts. It provides for the formation of districts by petition and vote, and for the governing of districts by a board of five to nine elected directors. Such districts have the power to issue bonds and levy special assessments.

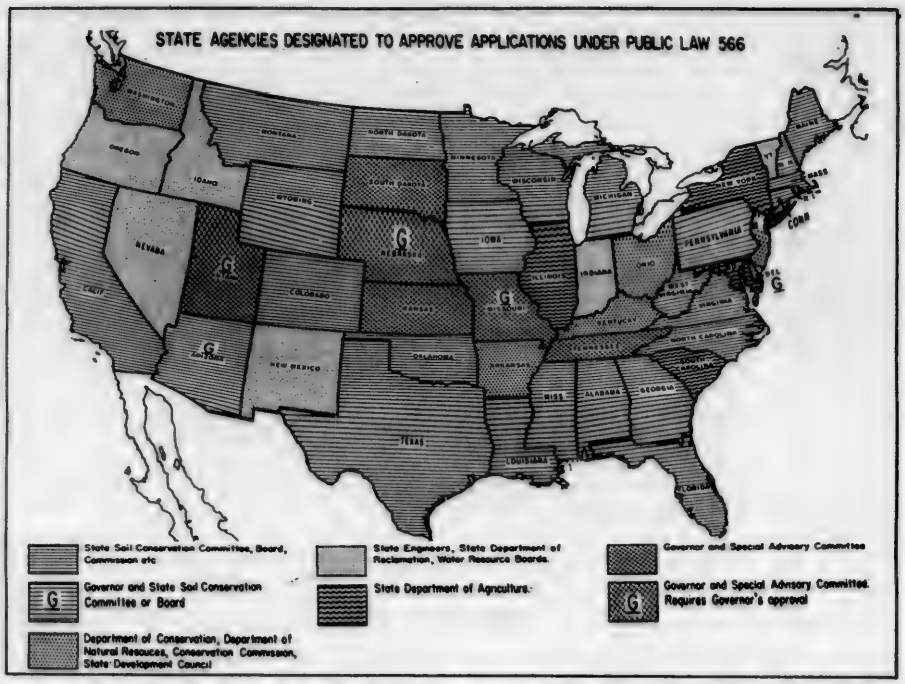
STATE AGENCIES DESIGNATED TO APPROVE APPLICATIONS UNDER PUBLIC LAW 566
State Soil Conservation Committee, Board, Commission etc
Governor and State Soil Conservation Committee or Board
Department of Conservation, Department of Natural Resources, Conservation Commission, State Development Council
State Engineers, State Department of Reclamation, Water Resource Boards.
State Department of Agriculture.
Governor and Special Advisory Committee
Governor and Special Advisory Committee. Requires Governor's approval

Figure 2. This map shows how the states are organized to cooperate with Public Law 566.

The Minnesota statute, on the other hand, provides for the creation of watershed districts by the State Water Resources Board upon the petition of resident freeholders of any county, city, village, or borough. It provides that each district shall be governed by a board of not less than three nor more than five managers appointed by the county board of the counties affected. It provides power to incur debts, liabilities, and obligations; levy assessments; issue certificates, warrants, and bonds, and exercise the power of eminent domain.

The amendments to the Kansas law provide more specific definitions of qualified voters, amends the method of selecting district directors and repaying special assessments. The amendments to the Nebraska law enlarged the area of responsibility of watershed districts and modified various provisions relating to procedure for establishment of the districts in the interest of simplification.

Other Special-Purpose Districts

Many special-purpose districts have been created for the purposes of undertaking drainage, irrigation, flood control, or other features of water management. During 1955, Wyoming passed a new flood control district law providing for the creation, upon petition to the Board of County Commissioners, of special flood control districts to be governed by a board of six elected directors. This law gives districts the power to issue bonds and to levy, through the Board of County Commissioners, an additional real property tax not to exceed 12 mills.

Mississippi and Delaware amended existing drainage district legislation to broaden it to permit cooperation in watershed protection and flood prevention projects authorized by Public Law 566.

Connecticut provided for the creation of special-purpose districts having the power, among others, to plan, construct, and maintain flood and erosion control systems. Each district is to be governed by a flood and erosion control board. Any municipality may exercise through such a board the powers granted to such districts. The law authorized the board to defray the cost of constructing any flood and erosion control system by issuing bonds or other evidences of debt and from general taxation, special assessment, or any combination thereof.

Texas took a different course of action. Its legislature created two special-purpose districts to cover watersheds in which local interests desired an organization qualified to obtain assistance under provisions of Public Law 566. These are local acts in contrast with general enabling legislation.

Conclusions

Public Law 566 is little more than a year old. Action under its provisions and the 37 pieces of legislation enacted by 20 states in 1955 is in its first stages. It will probably be several years before the effectiveness of both the Federal and state legislation can be fully appraised. As the watershed protection work moves forward and becomes better understood, the kinds of state legislation that

(*Continued on page* 301)

Putting Land to a Safe and Sustaining Use Through Zoning

W. A. ROWLANDS

WHERE YOU FIND problems, you also find opportunities for the creation of new productive enterprises on the land. Certainly an organization as young, as vigorous and as purposeful as the Soil Conservation Society of America, with its high ideals of public service, will always be in a position to do things for the welfare of America worthy to be remembered. Progress is made by people who dare!

I should like today to divide my talk into three major divisions. These are:

1. The extent of the land use planning and zoning movement in America.
2. The need for improvement in land use education and administration.
3. Ways of resolving problems of conflicting uses of lands.

The Extent of the Land Use Planning and Zoning Movement in America

Let me begin by sketching quickly the extent of the planning and zoning movement in the United States and Wisconsin.

The United States Chamber of Commerce estimated in 1948 that more than 1,200 cities and towns in America had some form of zoning. In 1949 zoning regulations had been enacted by 173 counties out of about 1,100 counties in 29 states authorized to do so.

In Wisconsin 131 cities and villages have zoning ordinances. Forty-four of our 71 counties have some kind of county-wide zoning. In addition, 14 civil towns have adopted special zoning ordinances. It is estimated that 82 per cent of the people of our Wisconsin cities and villages now live in zoned communities.

Zoning is firmly established in American law. The Supreme Court of the United States and the supreme courts of many of our states, including Wisconsin, have left no doubt as to the constitutionality of a carefully drawn zoning ordinance, urban or rural. As a matter of fact, the courts are declaring more clearly and to a greater degree than ever before that zoning is not nuisance legislation and that even zoning for esthetic reasons alone may be justified.

The earlier rural zoning ordinances, like the automobiles of early years were simple, practical, and designed to fit the needs of that day. Two of the most important objectives were to segregate non-agricultural land from agricultural land and to promote economy in government services.

Simple as they were they served their purpose well—far beyond the dreams of those who wrote them. Under these rural zoning ordinances, forest areas were established and through the operation of the Wisconsin Forest Crop Law forests were planted and developed. Upward of a thousand isolated settlers were voluntarily relocated to established farming communities or to urban centers. Fires were reduced in the restricted forestry districts under zoning. Abandoned shacks on county owned lands were salvaged or destroyed and the forest constantly improved. Rural zoning and the relocation of isolated settlers demonstrated and gave force and meaning to the statement *"that mere courage cannot extract from a sterile environment sustaining wealth."* The Soil Conservation Service, I am happy to say, gave substantial help to Wisconsin's settler relocation program.

Now, we are assisting the county zoning committees (1) in re-examining and redesigning these ordinances to meet some of the new problems we have today, and (2) in developing and carrying out a carefully planned educational program for very step and every stage in the process.

To do this well, we need to know more about rural America. The flight to the country has already begun. New towns are being developed and settled, retired couples are taking to rural areas, new industries of many kinds have established themselves in the country, and recreational uses of lands are growing by leaps and bounds. That is why we must know more about our lands and the desires of the people on the land. We can hope that groups such as this will help provide the answers we will all need in the very near future.

Someone, and I think it was Hugh Pomeroy, has said that: *"The real value of a zoning plan lies not in its scientific fabrication nor its triumphant adoption but in the story of the long years ahead when it guides community development."* In all planning and zoning work there is a need for flexibility. We must modify the details of our plans as new facts become available, as new legislation changes our methods and procedures, and as growth and development demand it.

So much for the record and the past. Our problems are in the future. In a country which is expanding and

This paper by Walter A. Rowlands, a member of the SCSA, was presented at the Tenth Annual meeting of the Society held at Green Lake, Wisconsin, September 12, 1955. *Mr. Rowlands is associated with the College of Agriculture, University of Wisconsin, Madison, Wisconsin.*

developing as rapidly as America we can look forward to many changes and new and greater opportunities.

The Need for Improvement in Land Use Education and Administration

Educational Work—An Essential Part of Planning and Zoning—

It is important that zoning ordinances and everything about them be made simple, direct and easily understood. We cannot keep zoning a secret, but we can emphasize the positive, the protective features of zoning rather than the negative and prohibitive. In an effort to state simply the positive objectives of zoning, my Advisory Committee on Zoning at the University proposed the addition of a paragraph in all zoning ordinances which reads as follows:

"The provisions of this ordinance are intended to encourage the use of lands and natural resources in blank County in accordance with their character and adaptability; to promote orderly development; to secure safety to life and property; to protect highways from econmic suffocation by encroaching uses; to preserve land values; to encourage and promote public health, morals, safety and general welfare."

A few years ago the Planning Commission of the City of Baltimore put out a special bulletin on the need for planning and zoning entitled *"Everybody Plans."* It is one of the best and most complete pieces of educational work in urban planning I have ever seen. It tells a great story and it tells it well. We who are interested in rural land development likewise have a great story to tell. We need to tell it again and again, in new films like *"The Plow That Broke the Plains," "The River,"* and in attractive circulars like the one the Soil Conservation Society of America recently released on *"The Story of Land Through the Centuries, Its Use and Misuse."*

Next time let us do our films in color with pictures like the *"Plainsmen," "Cimarron," "Covered Wagon," "Cherokee Strip," "The Good Earth," "Wells Fargo"* and *"Gold Is Where You Find It."* These pictures told a dramatic story of man's quest for land. They put romance and adventure into it. They had a wide appeal and they were box office attractions.

Then there is the town meeting. In Wisconsin the objectives of land use planning and rural zoning have been presented and discussed in almost every community in counties enacting rural zoning ordinances. The town meeting is the place where local people speak out, where questions are asked, votes are taken and decisions made. Land planners, I believe, ought to continue to use the medium of the town meeting for discussing land programs. It is one of the main strongholds of democracy in America.

We need to bring other professional groups into the field of planning and zoning and relate our work to theirs. Professor J. Beuscher of the University Law School has recently been discussing the need for land use planning and zoning and the provisions of new legislation on subdivision control and regional planning with members of the legal profession, with highway people and with real estate groups—all in order to show how and why these professional groups can be of help.

It is tremendously important that local people be brought into the plan making process. They should always be considered and consulted in the development of plans which affect them. Success in land use planning and zoning, I believe, can be quite accurately measured on the basis of the kind of relationship planners have with local residents in the communities they wish to serve.

City and County Agencies Must Plan Together

Cities are constantly extending their boundaries to take in new residential villages and new agricultural lands. Some cities are asking for territorial control over lands three to five miles beyond their incorporated limits.

Because few, if any, laws have been enacted requiring city and county planning and zoning commissions to meet together at stated intervals to discuss mutual land problems, many county and city planning groups never have met together in any official capacity. A great deal of good could be accomplished by joint meetings of these two groups. We might even eliminate the situation which took place in one county not 1,000 miles from here. When the county zoning committee brought the newly amended zoning ordinance to the county board for passage, almost all of the members of the City Council (City Supervisors) on the County Board voted against it. They did this because one of the towns bordering the city had placed the land adjacent to the city boundary in a newly created residential use district. On inquiry it was found that the city had planned to buy land in this town for establishing a city dump. The town board did not want the city dump in their town and the City Supervisors did not vote for the ordinance.

Administration and Enforcement of Local Ordinances—

This is where our rural zoning ordinances are the weakest. We need to have a qualified zoning administrator in every county with a zoning ordinance. We need further to adopt the system of enforcing zoning ordinances through the issuance of building, use, or occupancy permits. We need somehow to devise a way to inform all buyers of rural real estate of their rights and privileges in the use of their land. The buyer of rural property needs to have a precise and clear concept of what he can do with his land, whether it is zoned or not, what type of use district it is located in, what uses are permitted and what are prohibited. In short, what it is that is being bought or sold. Edward M. Bassett, a member of the New York Bar and a recognized leader in the zoning movement in America, has pointed out that *"All owners hold their land subject to the police power regulation of the com-*

munity, whether for health, fire protection or structural safety." These regulations are not found in the official land records, but all persons are presumed to know the law.

It has been well stated that, in America at least, logic has more power than law. There are, therefore, some extra legal steps not required by law that may well be taken by county agricultural and zoning committees that will help explain the basic objectives of land use planning and rural zoning and thereby simplify their administration.

Annually many of our Wisconsin County zoning and forestry committees hold an all day county-wide tour with stops at such places as forest plantations, submarginal farms, isolated settler relocations, lands leased for cabins on county owned lands, proposed zoning changes, new proposed dams and flowage areas, river or watershed development, proposed land purchases and exchanges and community drainage developments. Annual tours of this type are generally attended by all county board members and often by city and village officials. We need to revive and improve these county tours, they are a wonderfully effective method of doing educational work in land use planning and in resource development. The town and county officers who take part in these tours are the people responsible for the planning and for the local administration of existing ordinances. They recognize the fact that a well directed educational program will simplify their administrative and enforcement problems.

Generally one special topic is considered at the noon luncheon on these tours. It may be aerial photography, land inventory, fish development, the proposed construction of a dam, or a proposed watershed development. Always it's a problem of land, of people and of resource development.

Ways of Resolving Problems in Conflicting Uses of Land

Forests and the Multiple Use Principle—

When land resources are (or seem to be) abundant, we tend to think in terms of exclusive uses for land. Sometimes these are even one-time uses, as when timber is slashed and land abandoned.

As we begin to feel the pressure of population on land resources, we face the necessity of considering multiple uses.

Forestry is now the second largest single use of land we have in Wisconsin. We have about nine million acres of it. Forests have been an acceptable alternate use for land submarginal for farming. More of our unused non-agricultural lands in the north and the unglaciated steep lands in southern Wisconsin can profitably be used for forests. Farm planners of the Soil Conservation Service, district foresters of the Wisconsin Conservation Department and members of the Agricultural Extension Service recognize this and emphasize it in all their work.

Forests have provided an economic base for non-agricultural land—they have enhanced the recreational industry and have made possible the development of many profitable wood using industries, for many small Wisconsin communities. This fact has been well demonstrated by Ed Stiegerwald in his current series of articles in the Wisconsin Conservation Magazine under the title *"Forests—Meal Tickets for Small Communities."*

With our increasing population (Wisconsin has added half a million population since the first zoning ordinance was planned 25 years ago) it is none too soon to consider the opening of some of the most accessible parts of these new forests for public parks, for family camping and vacationing purposes for both local residents and visitors, in short, for multiple use purposes. Certain it is that our city, state and national parks are not able to take care of the needs of our ever expanding population. Records show that some of the parks and camp sites in our county and state forests are being used far more extensively than they were originally planned to serve.

This need for parks and vacation spots for people will continue. The need will be greatest among the most populated sections of the state. Something can be done to serve them, though perhaps not always just what they want. I am reminded of the letter Michigan's state highway commissioner, Charles M. Ziegler, got this spring from a Chicago woman. It said:

"Last summer my husband and I decided to take a trip in Michigan to see the Soo locks. After driving several hundred miles and arriving at Mackinaw City we learned that there was an hour's ride on the boat and another hundred miles by auto.

"In disgust, we turned around and drove back to Chicago.

"Can you tell me why the locks were built so far away from metropolitan cities, thereby depriving a great many people of this wonderful sight?"

Recreational Land Uses—

Planning and zoning committees have had great difficulty in planning for the rapidly growing needs of the recreation and resort industry. Just to have a special recreation use district, wherein all recreation can be placed, is not the answer. Resorts, summer homes, clubs and camps take advantage of unique natural resources. Clear water, timbered shore lines, sand beaches, fish and other wildlife and the calmness and quietness of a forest environment make valuable recreation assets. The many small businesses which serve the recreation industry do not need recreational quality land. Minnow stands, boat works, garages, machine shops, general stores, amusement centers, restaurants and motels can use land other than valuable lake shore sites.

The recreation industry has benefited greatly in Wisconsin from forest development and rural zoning. Wisconsin's landscape gets more beautiful each year. County zoning and planning committees have a real responsibility to continue to aid and encourage this growing industry. Dams and flowage areas have likewise created many new opportunities for the development of summer homes, resorts and other recreational enterprises. Zoning gives stability to these recreational property values which have created new wealth for the owner and new sources of income for local government.

We need to know more about the resort industry, its size, its impact on other industries and what it really means to the areas it serves. According to the Wisconsin State Board of Health in the last 14 years the number of licensed places serving the resort industry has more than doubled, in fact it has almost tripled in this 14 year period. There is apparently no such thing as a saturation point in recreational development. The people who come to Wisconsin for recreation come and get their fill of our climate, our lakes, streams, forests and other natural scenery and when they have gone they leave as much as there was before they came. The resort industry then sells much more than meals, lodging and personal services. It sells scenery, forests, clear water, game and wildlife, the results of wise land use. Its future is bound closely to the future of our woods, water and wildlife.

Game and Wildlife—

There is today among our many sportsmen and wildlife groups mounting pressure for hunting areas and a supply of game animals large enough to satisfy the demands from the densely populated sections of the state. I noticed the newspaper reports of the Soil Conservation Society meeting of June 28, sponsored by the Wisconsin Chapter on Wisconsin Wetlands. The newspaper account of this meeting was headed "Ducks or Potatoes?" I'd like to comment on this for a moment if I may. Thirty years ago there were surprisingly similar articles in the Wisconsin press entitled "Farms or Forests?" Wisconsin has today a fine network of federal, state, county, town and community and school forests as well as a rapidly increasing area of industrial forests. There were many problems, legal and economic, at that time facing Wisconsin's forest development program. It turned out that there was room for both farms and forests. *I'd like to put it in the record* as my opinion that *there is room in Wisconsin for both ducks and potatoes.* The conservation movement is too big, too important and too vital to America to have different professional groups fighting each other for space whether it is space in the newspapers or on the land. We need the abilities of the soils and agronomy technicians, the forester, the engineer, the game manager as well as the lawyer and the economist to be directed toward a balanced use of land and toward a sound ecological program. We need to do it however with the consent, co-operation, support and participation of local people.

There are, I believe, two essential principles required for the development of game areas whether for deer, sharptails or ducks. One, wherever and whenever our game people feel the best environment exists for the development of game areas of any kind, it is important that local citizens, local government and local organizations be considered and consulted in the development of any plans which affect their future. They must be brought into and made an essential part of the planning process, their views obtained and their co-operation secured. Secondly, somehow the cost of developing such an area must be financed in such a way that local government be not required to bear the total burden of loss of taxation of these lands. The principle of the Wisconsin Forest Crop Law ought to be studied as a possibility for eliminating local financial hardship to the community. This law has been in use for 22 years in 27 counties and—it works!

Agricultural Land and Agricultural Production—

Some of the members of this Society and economists generally have expressed the thought that in our rapidly growing nation too often our best quality agricultural land is going for industrial and residential purposes. This is true. At Madison we are losing our University Experimental Farms to the city. Professor Case of Illinois reports that Illinois lost 1,500,000 acres of farm land since 1900. This is an area equal to two counties the size of McLean County, Illinois. The experts point out that there is a definite limit to the amount of Class A agricultural land, and if this trend continues unabated future civilizations may be hard pressed for cropland for essential food production purposes.

It has been proposed that the best agricultural land be reserved through zoning for exclusively agricultural purposes. Historically zoning has protected residential areas against invasion by other land uses. Little consideration has been given to the protection of agricultural regions. A beginning in this direction has been made in some California and Wisconsin county zoning ordinances. In Walworth County, Wisconsin, for example, many plants operated for the purpose of disposal or reduction of garbage or rubbish and rendering plants, tanneries and the like are excluded in agricultural districts. They are located in industrial districts. Many people now recognize that we have areas which should be restricted to agriculture. Our problem is to locate, define and protect these areas as we do areas for other uses of land.

If we will take a broad view and a long look ahead in land use planning; if we will work constructively toward a balanced use of all our land resources; if we will follow the facts and not our fancy, then you and I may plan with people for the development of their land resources in a way worthy to be remembered.

We Elect to Study Conservation

EDRA W. SHARPE

This article shows what can be done to interest a group of boys and girls in conservation; also, how their teacher in literature helped them organize a well-planned schedule of activities. Materials and other resource needs were obtained from local sources. The school community was their laboratory.

Figure 1. The author shows a group of boys and girls how to test soil for lime requirement.

THE MEMBERS of the Suncrest Flatts Junior High 9-4 Literature Class having completed units in short stories, novel, poetry, informational reading, travel and other units, had their choice of several units, among them a period of free reading; reading of a play; Greek and Roman Mythology; a unit on poetry or a unit on conservation. The choice by a wide majority was conservation.

They are an ordinary group of youngsters, 29 boys and girls of average intelligence. They have comparable background and economic status. Most of them are the children of glass workers, miners and small farmers. In all cases they would be considered rural children, each having experienced home gardens, potato and corn "patches" and yards with flower beds.

Pupils often live in a vague world with a lot of half formed ideas about a lot of things, but not enough knowledge to be able to express themselves about any of them. So when the question *"What is Conservation?"* was put to them the answers were vague, incomplete and in most cases immature. About as near as they could come to a definition was: *"It is a conservation officer." "It means saving food." "Everything ought to be kept green." "People who make us obey hunting and fishing laws."*

Edra W. Sharpe is a teacher of literature in the Suncrest Flatts Junior High School, Morgantown, West Virginia. She has also been active in the West Virginia Chapter of the SCSA.

Library Used Extensively

Before the first class session hardly got under way the students realized they could not talk about conservation well enough to make any plans for the unit's work. Since they are fairly well informed library users, a pupil's suggestion that "we see what the library has on conservation that will help us" was wholeheartedly accepted.

A wealth of material on every phase of conservation the teacher could anticipate they might need was at their disposal. The collection consisted of books, magazines, pamphlets, leaflets, pictures, charts and maps. A special effort had been made that the material be attractive in appearance, authentic, of recent publication date and cover a wide range of reading ability.

They began by assembling the materials on a reading table in the manner they felt it belonged. It naturally fitted itself into such subjects as soil, water, forests, natural resources and wildlife conservation. Long before the table was completed one pupil slipped off to a corner to read a West Virginia conservation magazine; another had found a comic-type book on water and two girls were chuckling to themselves as they read Sam and Sue to each other. They did not have to be told to read; they were ready.

There was no break the next day—just a group of very busy readers—until late in the class period when the teacher asked for a short "air-your-thoughts" session. Here began to be revealed some conceptions of the wide scope of the term, "conservation." Where one pupil had delved into the idea of stocking fishing streams others had read on widely varying subjects such as: grassland farming, the raindrop, tree farms, nutrition and water power.

In this session it was found the pupils generally lacked a conservation vocabulary. They needed to know the meaning of many words and terms before they could read intelligently. In order to expedite the matter, it was agreed we would prepare a general conservation vocabulary by ditto for each member of the class from the terms and words that had come out of that discussion; then each student would be responsible for building to the original list. A worthy vocabulary list was emphasized as a necessary accomplishment of the unit's work. The task was well received and immediately the newly acquired words began to open up new channels of thinking and reading.

Panel Discussions Are Regular

The reading brought out to the pupils that the conservation story fits itself nicely into four categories: Soil and water conservation, forest and natural resource conservation, wildlife conservation and human conservation. Since panel discussions were new to the group, that was the agreed manner of presentation. So four leaders were elected, fields of interest were chosen and the pupils identified themselves with one of the groups.

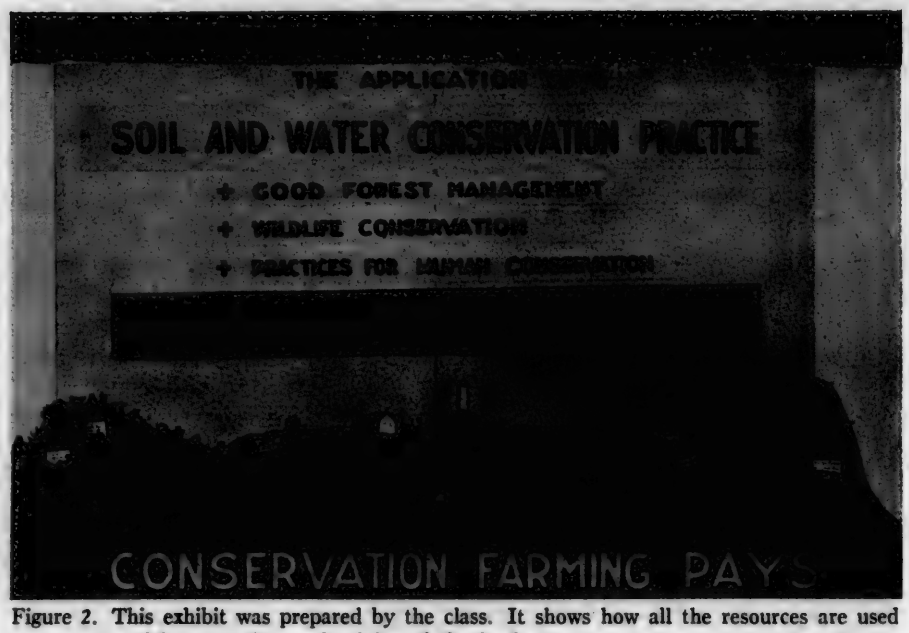

Figure 2. This exhibit was prepared by the class. It shows how all the resources are used to protect and increase the productivity of the land.

Now each panel set out to develop its chosen phase of conservation into balanced, well integrated, interesting topics for presentation. Here close guidance was given to avoid letting pupils get lost in blind alleys, frustration, overlapping and to assure coverage of the subject. There was one stipulation made by the teacher that at least one Audio-Visual presentation be a part of each panel's work.

The days spent in selection of the materials and the actual organization of that material brought forth excellent examples of individual work. Much reading was done. Many individuals were consulted: The science teacher, home economics teacher, conservation officer, soil and water conservation specialist. Maps were prepared, soil testing kits secured, films provided, pictures chosen and a model farm was built.

The Soil and Water Conservation panel used as its basic text the soil and water handbook prepared for the Youth Conservation Camp held at Camp Caesar each year. Other books and sources came into use as their needs and knowledge of their field broadened. The study of minerals in the soil sent them to general encyclopedias, agriculture yearbooks, science books; also the science teacher's knowledge and help was solicited.

The study of trace elements fascinated one home economics-minded pupil who carried the search into and shared the information found with her cooking class.

The simple lime testing of soil was performed in the class when several pupils brought soil samples from their own gardens and boys and girls alike made the test and interpreted the results.

The soil itself became a living thing to the class as they saw the films, *"Birth of the Soil"* and *"The World at Your Feet."* We found that just as pupils must study themselves to find what work they are best fitted for in this world, so must the soil or land be studied. In conservation farming we adopt the idea that all land must be protected in the manner its make-up requires, treated according to what its needs are and used in the way it will yield its greatest service to mankind for all times. All this brought about a deeper meaning of newly-learned terms; strip cropping, rotation, top soil, erosion, watershed, watertable. It was with a sense of shock that we viewed the film, "The River." Our new thinking gave this picture a great impetus.

Resource Fields Are Covered

The Forest and Natural Resource group very quickly moved into interest fields easily identified with their background and experience: Water power, wood industries, glass, pottery, coal and salt. A survey of the class showed the entire group had lived all their lives in the industrial sections of our state. Forests in West Virginia was an entirely new thought to them. Woods, yes —but not forests. The United States Forest Service was an accepted fact for it had been a part of their civics and science class experience, but even that was thought of as something that happens in remote western states such as Wyoming, Idaho or California. The West Virginia State Park and state forest system was completely new to the greater portion of the class. They knew of Cooper's Rock. Most of them had been there, but to them Cooper's Rock is a picnic sight with an unusual view, not a part of a State Forest.

A bit of research brought what we needed on woodland management, the planting and selecting of West Virginia's forest trees and how our forests are protected. The West

Virginia Conservation Commission pamphlets and the Blue Book were more than adequate to get the proper perspective and stress the great importance of our State Forest and State Park system in introducing our beautiful state to the rest of the nation, and the economic value to our state and their interest in it as young citizens.

This panel prepared a huge wall map of West Virginia on which they indicated the National Forest holdings, state forests, state parks, locations of water impoundments such as the Tygart and Bluestone Reservoirs, the Monongahela River locks, clay, sand, coal and salt deposits, glass, pottery and chemical industries.

Wildlife conservation was almost a coveted position. Many of the boys hunt and fish as do a few of the girls. They all have brothers or fathers who follow the sports. But to look at the subject from the conservationist's viewpoint, gave it quite a different light.

We learned of the fish and game conservation program of our state carried on through the Conservation Commission. Fish hatcheries and game refuges were heard of for the first time by many class members. The West Virginia Conservation Commission magazine afforded much informative and recreational reading. Having gathered up a generous supply of the magazine, the panel members surprised and treated us one day by allowing us a large portion of the period for just enjoying them.

The life of a conservation officer was given by a pupil who had personally contacted the officer several times in order that her report be authentic. Because of the busy forest fire prevention season, the officer could not attend our class. Conservation laws took on a different meaning when they were presented as means by which we protect our wildlife while at the same time making better fishing and hunting for all.

One pupil chose to tell what we can do to help the Wildlife Conservation program. His suggestions included bird feeding stations, planting of fruit-bearing shrubs, proper picnic etiquette and hiking conduct. Another member with considerable hunting experience stressed proper gun conduct.

The pupil's work was concluded by the presentation of the film, "REALM OF THE WILD." *Here the class caught the idea of the balance in nature, a fitting climax to the panel's work.*

Poor lands make poor people. Poor people make poor communities. With the help of a soil conservation specialist, the Human Conservation group built a model farm. As this was the climaxing point in the study, all of the newly acquired ideas were used in its building. Fences were placed according to the capability of the land; crop lands were stripped with sod water ways; grasslands were treated for mineral deficiencies; steep hills were planted to trees and fenced; hedge rows of food and shelter for birds and game were planted and the farm pond was stocked with fish.

The Answers Were Different

With their farm as evidence the panel developed their theme *"From the Good Earth Comes the Good Life."* The conservation farmer supplies better produce for the market—greater quantities of more nutritive fruits, vegetables, milk and meat products. He not only helps to determine very much the health of his community and his nation, but because of his better economic status he helps to determine the standard of living that is realized by his countrymen. A properly fed, economically secure nation can assure its people better institutions of education and culture (schools, churches, libraries), better health protection (water and sewage systems, public health centers, hospitals), and more and better recreational facilities.

Following the completion of the course of study the question was asked: *"What is Conservation?"* The answers were different now. They were more thoughtful and more complete.

The choice answer was submitted by one of the girls of the class. ***"Conservation is the science of understanding the interdependence of soil, water, forests and wildlife and using them in such a way to produce maximum of material, food, shelter and pleasure without losing these resources for future generations."***

Soil Surveys in Modern Farming

(*Continued from page 276*)

midst of a technical revolution in agriculture. *As one example among many: One man now produces more than twice the bushels of corn that one man did only 14 years ago! In fact, the efficiency of agricultural workers generally has been going up for some time at about six per cent per year.* The combinations of practices that make these phenomenal increases in efficiency possible apply unevenly to the different kinds of soil. Many of the older interpretations of soil surveys involving corn, for example, are not only wanting in precision now, they can even be misleading.

Thus our soil surveys to serve the farmers must be continually reinterpreted as conditions change. We can best serve our farmers by giving equal emphasis to sound scientific soil surveys where we make such surveys and to continual study and reinterpretation of the results. As capital costs in farming increase, the importance of an accurate fit between kinds of soil and combinations of practices also increases. Although our total job in soil surveying and in keeping our interpretations up to date increases, the rewards in terms of increased agricultural efficiency increase even faster.

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Erosion and Over-Population Pose A Serious Problem in Barbados

T. S. BUIE

BARBADOS, THE MOST eastern of the West Indies, lies about 13 degrees north of the Equator, and embraces an area of 166 square miles. Most of its 220,000 people are engaged in agriculture. Sugar cane is the principal crop grown. On six-sevenths of the island the soil, although shallow in places, is of limestone origin and very productive. The slopes generally are not steep enough for erosion to be a serious problem.

There is, however, an area of approximately 22 square miles where erosion is a serious problem. Here, the covering layer of limestone has been removed by geologic erosion, leaving exposed readily erodible clays and sands. This is known as the Scotland District, doubtless so named by the early settlers because the hills and valleys reminded them of Scotland. All of this area lies within three to four miles of the ocean, and has as its interior boundary a limestone escarpment which reaches an elevation of 1000 or more feet. Steep slopes are quite common and continued use of the land for cultivated crops has resulted in severe erosion and consequent abandonment of many acres.

Sheet erosion is widespread in the Scotland District and only the protection afforded by the growing cane has kept it from being even worse. There is at present on many abandoned hillsides only a sparse growth of grass and shrubs, and grazing by domestic animals owned by the peasants reduces to a minimum the effectiveness of such cover.

Gullies, the second stage of erosion, range from finger-like depressions to deep chasms extending upward from permanent or intermittent stream channels. The regenerative processes of nature are held in check by the continued grazing of the ever-present cows, sheep and goats, and the removal for firewood of all woody growth.

The continued development of gullies is to be expected so long as steep slopes are cultivated without the application of remedial measures, and the most necessary of all these remedial measures is the elimination of row crops.

Another unusual form of erosion known as "slippage" occurs whenever the causative factors of soil type, steep slope, under-cutting by gully or ditch, and saturation of surface soil exist. Where these are found together, masses of soil ranging from a few feet across to whole sections of a hillside, slip down hill. Growing crops—even trees—are carried along, road and stream channels are blocked, and other serious damage is caused.

Figure 1. Bananas planted "up and down" hill on a steep hillside encourage soil erosion.

The soil condition which is particularly susceptible to this type of erosion has a pervious surface layer which is underlain, at varying depths, by an impervious clay. Consequently, practices which ordinarily induce surplus water to enter the soil may, under these conditions, actually encourage slippage. Advancing gully heads usually assume a slope rather than a vertical face as is common in most soils. The angle of the critical slope is lessened as the moisture content of the soil is increased, for when the soil is saturated it is much less stable than when dry.

Just as the several types of erosion—sheet, gullying, slippage, and stream channel—are interrelated, so must control measures embrace all known types of treatment. Included are: Elimination of row crops from steep hillsides, contour cultivation, terracing, strip cropping, engineering treatment of all stream channels, and devices for the rapid removal of surplus water before it has opportunity to do damage either to the growing crops or to the land. Expressed differently, it is absolutely necessary to bring into play all appropriate control measures bound together to make a coordinated plan of attack. And, in addition, both men and animals must be excluded from portions of the area if the treatment is to be effective.

It is difficult for Americans, accustomed as they are to thinking of land in terms of vast acreages, to visualize the importance of such a small area as 22 square miles. But

T. S. Buie, a Charter member of the SCSA, spent three weeks in Barbados, British West Indies, as soil conservation consultant of the Foreign Operations Administration. Dr. Buie is state conservationist, Soil Conservation Service, Columbia, South Carolina.

Figure 2. These scenes show severe erosion in Barbados, British West Indies. *Left:* Severely eroded slopes on East of Scotland District. *Right:* "Slippage" erosion where large sections of soil slip downhill when the surface layers are saturated.

the number of people to be supported makes it quite important.

Barbados is one of the most densely populated agricultural areas to be found on the face of the earth. Considering an even distribution of the 220,000 people who live on the island, there are more than 30,000 who are dependent upon the Scotland District for sustenance.

The problem is well-nigh insoluble unless strict measures of land use are adopted. And the need for every acre of land for the production of human food makes impracticable the retirement from cultivation of any appreciable acreage. There is nowhere else for the people now dependent upon this land to go. The situation is further complicated by the rapidly increasing population—4,000 per year. In 50 years, if this numerical rate of increase continues, the number of people will be doubled. *One cannot say, "Plant the badly eroded areas to trees, let them grow, and forget about the problem for 25 years when it will have solved itself."*

Without question the density of population and the consequent need for the most efficient use of the land presents a challenge, a challenge sufficient to tax the abilities and ingenuity of the best agricultural knowledge and soil conservation principles available. And the two-fold problem found in Barbados—that of increasing population and shrinking land resources—may be regarded as a preview of what a large part of the world may face within the next few decades unless the conservation program can be so accelerated that it will at least keep up with the expanding population.

Legislation for Watershed Protection and Prevention

(*Continued from page 292*)

are most effective in enabling local people and the states to cooperate with the Federal government undoubtedly will become more apparent.

Some of the legislation enacted this year may prove to be ineffective or even unworkable. If so, additional new or amendatory legislation will be needed. The effectiveness of existing legislation needs to be evaluated. It seems probable that most, if not all, states eventually will need to take additional legislative action to obtain all of the assistance which the secretary of agriculture is authorized to furnish under Public Law 566. State-wide organizations, as well as study commissions established by state law, even now are giving attention to this problem in several states. It is to be expected that additional legislation will be considered by many state legislatures during their sessions in 1956 and 1957.

The specific questions that need to be studied in most states appear to be these:

1. Does the executive branch of State government have, as contemplated in Section 3 of Public Law 566, an appropriately organized and staffed "State agency having supervisory responsibility over programs provided for in this Act"?
2. Does the state recognize its fiscal responsibility for participating in carrying out, operating, and maintaining watershed works of improvement?
3. Is it recognized that people in a watershed must be given a means to levy taxes upon themselves and exercise eminent domain in order to carry out, operate, and maintain works of improvement?
4. Should these needed local governmental powers be exercised through (a) counties, towns, or other political subdivi-

sions, (b) soil conservation districts, (c) watershed districts, or (d) other special-purpose districts?

5. Is it recognized that soil conservation districts or other organizations having comparable powers are an essential part of the "local organization" structure to comply with the provisions of Public Law 566 to "obtain agreements to carry out recommended soil conservation measures and proper farm plans from owners of not less than 50 per centum of the lands situated in the drainage area above each retention structure to be installed with Federal assistance"?

Whatever the decisions may be, it is timely for conservationists to scrutinize critically their existing state laws and to work toward such amendments or new legislation as may be needed.

Continuous Cultivation—Its Conservation Significance

(*Continued from page 285*)

oats, meadow and the four-year rotation of corn, oats, meadow, meadow, are at a distinct disadvantage economically according to this study. In citing these data I must call attention to the research underlying possible new techniques in grassland culture which may, when translated into agricultural practices, so increase the efficiency and profitability of milk and meat production by forage crops as to lessen the economic disadvantage now assigned to forage production on good corn belt soils. I expect further development of better technologies and their adoption by farmers to give rotations high in meadow crops a better position economically relative to those rotations high in proportion of corn.

A similarly calculated table for Clermont soils representing the "buttermilk flats" of southeastern Indiana results in the following predicted average, annual, net returns per acre for the different rotations:

Continuous Corn	$58.44
Corn, Corn, Beans, Wheat, Meadow	39.23
Corn, Wheat, Meadow	27.08
Corn, Wheat, Meadow, Meadow	20.73

Although some of the folks reporting on continuous corn experiments under new technologies point out that continuous corn with proper management will not be nearly as conducive to erosion as it has been under the old systems of management, I still believe that it will be safer to follow the current land use recommendations for sloping lands until good and complete experimental work on such areas may justify a change in cropping patterns. It will take considerable testing to determine just how much a man may be able to intensify corn on sloping lands using the new cultural practices without serious losses of soil by erosion.

On level lands there seems to be no doubt that on certain soils it is possible to greatly intensify corn, that is to increase the number of years of continuous corn in a cropping pattern, without critical loss in soil productivity providing certain managerial steps are taken. These steps are the maintenance of a high fertility level, the use of as little tillage as possible, planting at a population rate adequate to take advantage of this high level of fertility and the use of methods of returning crop residues to the land which will insure the greatest return of organic matter. Even with these precautions, this type of culture will be dependent on a supply of moisture throughout the growing season adequate to mature properly the thickly-planted corn crop.

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HANDBOOK FOR TEACHING CONSERVATION AND RESOURCE USE. National Association of Biology Teachers, *P. O. Box 2073, Ann Arbor, Michigan. 500 pages, illustrated. 1955. $4.00*

The best means of helping children understand the importance of our natural resources are expertly described by teachers in the *Handbook for Teaching Conservation and Resource Use*, a 500-page illustrated book just completed by the National Association of Biology Teachers.

The publication was prepared by two hundred teachers from thirty states, and shows how they have incorporated conservation and resource-use teaching into the schools. The *How to Do It Stories* and eighty-two pictures will help other teachers and youth leaders see *How to Get Started, Where to Get Help, What to Do in the Classroom, How to Use the School Grounds and the Community*, and how to develop such projects as school forests, school gardens, school camps, wildlife sanctuaries, outdoor laboratories, nature trails, and museums.

The material for the Handbook has been collected by the National Conservation Committee of the National Association of Biology Teachers since 1951 under the direction of Dr. Richard L. Weaver, the project leader, of the School of Natural Resources of the University of Michigan. The four-year project was financed by a grant from the American Nature Association.

FORESTRY HANDBOOK. Edited by R.D. Forbes, *Society of American Foresters. The Ronald Press Company, 18 E. 26th Street, New York 10, New York. 1220 pages, 340 drawings, sketches and photographs. 1955. $15.00*

Here is a reference book of facts which brings within easy reach the working methods, techniques and other important data needed by foresters, conservationists and technical workers concerned with practical forest resource problems.

The handbook was prepared under the direction of the Society of American Foresters with the help of more than 140 contributors. It is profusely illustrated with 340 drawings, sketches and photographs. Eight years were required to prepare the material which includes virtually every known aspect of forestry and its related resources.

The material in the handbook is organized in 23 sections—each carefully indexed. Conservationists will, in addition to basic forestry subject matter, find complete sections covering *watershed management, geology and soils, wildlife management, recreation, aerial photography* and others equally important. The user, therefore, has at his command not only information concerning his own special interest, but also techniques and knowledge in related fields. There is no other publication having so complete a coverage of practical data required in the day-by-day work of resource technicians.

The watershed management section, for example, covers such items as the hydrologic cycle, precipitation, transpiration, infiltration, soil moisture, run-off and streamflow, erosion, use of water and water units and measurement. Other sections are equally as thorough in their coverage of basic information required by field workers.

TEXAS WILDLIFE. By Everett T. Dawson. *Banks Upshaw & Company, Dallas, Texas. 1955. 175 pages, including glossary. Illustrated. $3.20*

The author of *Texas Wildlife* is director of Conservation Education and Publications, Texas Game and Fish Commission. He was once a game warden for the commission and he writes of Texas wildlife from personal knowledge. He is a man who loves people and who loves the wild things about which he writes. In this book he is introducing his friends to each other.

Although the title implies *just* Texas, most of the birds and animals, fish and amphibians described may be found over the entire Great Plains area of the United States. Many of the migratory birds spend the summer in Canada, and some of the birds and animals live part of each year in Mexico, Central or South America.

This book consists of thirty chapters, twenty-nine of which cover important, individual species of wildlife in detail: What they look like, where they live; what they eat and what eats them, how they get water, and how they act. Each chapter subject is illustrated by a full-page, beautifully detailed colored painting, plus black-and-white sketches. These pictures show the normal habitat and characteristic poses, and add immeasurably to the value of the book.

Listed among the enemies of the wildlife species are: Improper land use, soil erosion, drought, floods, hunters, trappers, fishermen—and speeding cars—a sorry commentary on our "civilization."

All through the book are true stories about the species being discussed. Their good and bad habits (according to the viewpoint of men) are given.

Mr. Dawson is a conservationist—aware of the interrelation of the welfare of all living things: Humans, plants, animals or reptiles. The last chapter of *Texas*

Wildlife is on "Conservation," defined by the author as meaning: *"to use the natural resources in such a way as to get from them the greatest good for the greatest number of people for the longest period of time."* This chapter touches, simply and briefly, on the need for conserving *all* our natural resources. The book is full of suggestions on good sportsmanship, as well as good conservation. The impersonal, inexorable working of the *"balance of nature"* is brought out in the text, and the author even finds a good word to say for the diamond-back rattlesnake! The need for laws to protect certain species from extinction is brought out. Some of these laws will have to be international, as in the case of migratory birds.

This book was written *"at the sixth grade level,"* as a supplemental reader for schools. The lucid and interesting material will appeal to any reader, of whatever age.

—MARGARET KING DAVIS, *Denver, Colorado*

AGRICULTURAL REGIONS OF THE UNITED STATES. BY LADD HAYSTEAD AND GILBERT C. FITE. *University of Oklahoma Press, Norman, Oklahoma, 288 pages illustrated. 1955. $4.00.*

Here is a book that concerns itself with the economic and geographic factors that make our agriculture what it is today. The story is told in an interesting and challenging manner by two of America's foremost writers in this field. Their views are based on original observation and experience in various parts of the country.

The book tells you all about the American farmer and his living habits. In so doing, the authors touch on such vital topics as values of farm land and the factors which determine buying and selling habits; long shifts in American agricultural production—what areas are best suited for certain types of farming now—and in the future; crop and livestock production by areas and states; current problems facing the farmer and rancher: What can be done to solve them and a prediction of what may be expected in the future.

Interspersed through the book are many excellent maps, charts, photographs and tables which greatly add to reader interest. These along with the descriptive material, give life to the subject.

The book will have considerable appeal to conservationists and resource leaders. Soils maps and land use data are shown in connection with each regional presentation. An analysis of this material clearly indicates the shifts in agriculture and land use that are taking place. All this is excellent background material for resource planning purposes.

SOIL AND WATER CONSERVATION ENGINEERING. BY RICHARD K. FREVERT, GLENN O. SCHWAB, TALCOTT W. EDMINISTER AND KENNETH K. BARNES *John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, New York. 479 pages, illustrated. 1955. $8.00*

The purpose of this book, according to the authors, is to provide a professional text for agricultural engineering students interested in the science of soil and water conservation. All phases are adequately covered in a single volume for the first time—thereby giving an integrated approach to the entire subject of conservation. The book is well written and profusely illustrated with appropriate photographs, sketches and line drawings.

Although designed for classroom work, the book has wide application for engineers and conservation technicians working in the field. Much of the material is so organized that any subject can readily be found without referring to other literature. This, in itself, is an important feature of the book.

The opening chapter of the book outlines the general field of conservation as it affects the engineer. Additional items covered include hydrology, soil physics, erosion and its control, flood control, drainage, irrigation and other important engineering topics. Each presentation emphasizes the precise engineering design as the basis for lasting results. In this, the authors have done an excellent job in supplying field data to illustrate practical applications and provide design values and materials needed for the solution of many problems arising in the field.

GRASSLAND FARMING. BY GEORGE H. SERVESS AND GILBERT H. ALHGREN. *John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, New York. 146 pages, illustrated. 1955. $2.96*

This very fine book by two well known authors gives added emphasis to the grassland farming movement. It is written in an easy-to-understand style and covers every important phase of grass management.

The book was especially prepared for agricultural students in senior high schools, technical institutes, and junior colleges; also for farm operators and managers. The subject matter is designed to help in acquiring skills and making sound management decisions.

Grassland Farming contains 12 chapters—all dealing with active farming operations in grassland agriculture. Each chapter also contains a list of selected readings and a series of questions and activities suitable for classroom discussion and individual assignment.

GRASSLAND-LIVESTOCK HANDBOOK. REVISED EDITION BY THE JOINT COMMITTEE ON GRASSLAND FARMING. *University of Oklahoma Press, Norman, Oklahoma. 52 pages. 1955. 50 Cents.*

This newly revised edition is authored by the Committee on Grassland Farming representing 19 national conservation and agricultural organizations. The original first edition was entitled *Green Fields are Gold* and sold more than a quarter-million copies. It was later changed to *Grassland-Livestock Handbook* which sold another half-million copies.

Requests for the handbook continued to come in from

all sections of the country. New data from research and experience was incorporated in the new revised edition which contains 107 questions—all concerned with some aspect of grassland farming.

Covered in the handbook are sections dealing with establishing a Grassland Program, Irrigated Pastures, Hay, Grass Silage and others. Each unit contains a short foreword which is followed by a series of direct questions. The answers are in summary form and cover more important aspects of the problem.

Grasslands of the United States and Their Improvement. *Reprint of Papers from* JOURNAL OF AGRICULTURE AND FOOD CHEMISTRY. *Joint Committee on Glassland Farming, Box 30, Norwich, New York. 28 pages, illustrated, 1954-1955.*

Grasslands of the United States and Their Improvement is composed of seven articles which appeared in the *Journal of Agricultural and Food Chemistry* in October, 1954, and in January and April, 1955. It has been reprinted for distribution by the *Joint Committee on Grassland Farming.*

The information contained in this booklet should be useful to all persons interested in grassland agriculture. Since the United States Census reports and the annual volumes of Agricultural Statistics contain virtually no information on grasslands and their support of livestock, there is need for reports on this important phase of our agricultural economy.

Soils and Fertilizers in Taiwan. *The Society of Soil Scientists and Fertilizer Technologists of Taiwan. 14 Wenchow St., Taipec, Taiwan, China. 94 pages, 1954.*

This publication, made possible by the Joint Commission on Rural Reconstruction, contains seven full-length reports and twenty-five abstracts of selected research papers published in 1954. The abstracts are arranged under the following headings: Plant water relations, soil chemistry, rice and fertilizers, sugar cane and fertilizers, miscellaneous crops and fertilizers, land classification, and chemical fertilizers and manures. All of these subjects give a general sketch of the development in soil and fertilizer work on this Island.

Soils, Phosphates and Fertilizers. BY VINCENT SAUCHELLI, *Davison Chemical Company, Baltimore 3, Maryland. 32 pages, illustrated, 1955.*

This brochure deals with fertilizer chemistry in laymen's terms, and is addressed to salesmen, farmers, and laymen in general to give in simple, understandable language some essential, practical information on the feeding of soils and crops.

The author discusses kinds of soil, what soils contain moisture supply, water requirements of crops, controlling soil moisture, how plants feed, chemical fertilizers and soil fertility, plant constituents, plant nutrients, humus, commercial fertilizers and soil amendments, secondary and trace elements, using fertilizers, fertilizer materials, phosphates, and the relative value of phosphatic fertilizers.

Plant Ecology, Reviews of Research *(English and French)* UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION. *Columbia University Press, 2960 Broadway, New York 27, New York, 377 Pages, illustrated. 1955. $7.00*

Plant Ecology, Proceedings of Montpellier Symposium *(English and French).* UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION. *Columbia University Press, 2960 Broadway, New York 27, New York, 126 pages illustrated. 1955. $3.00*

This is another in a series of reports issued by the Advisory Committee on Arid Zone Research of UNESCO which met in London, England in September of 1952. It contains ten pages in French and English. Each presentation is accompanied by a bibliography and followed by a summary in the other language.

The authors, in each instance, review the research carried out on plant ecology pertaining to arid and semi-arid regions in their respective countries. Some of the countries covered in the report include the United States and Canada by W. G. McGinnis; Australia by J. Griffith Davies and Latin America by A. L. Cabrera.

The volume on *Plant Ecology, Proceedings of the Montpellier Symposium* held in France contains statements by twenty scientists from fourteen countries. It, too, is presented in French and English with summaries in the other language.

Subjects covered include structural and physiological features of vegetation, climatic, ecoclimatic and hydrological effects on vegetation, soil and vegetation and the influence of other factors.

Publications of Interest

Learning to Live With Our Land and Water—A Teaching *Unit in Conservation.* BY FRANCES C. CULLER. *South Carolina Association of Soil Conservation District Supervisors, Room 424 Calhoun Office Building, Columbia, South Carolina. 26 pages, illustrated. 1955*

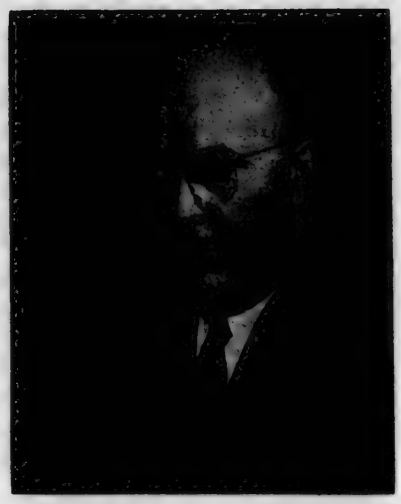
Planning School Forests—*Laboratories for Outdoor Education.* BY CARL S. JOHNSON. *Ohio Forestry Association, Southern Hotel, Columbus 15, Ohio. 30 pages, illustrated. 1955. 25 Cents.*

Report of the Natural Resources Board—1954. BY P. GORDON DEEDS, *Chairman. Natural Resources Board, Salisbury, Southern Rhodesia. 46 pages. 1955*

Groundwater Resources in Lee and Whitesides Counties. BY ROSS HANSON. *Report of Investigation No. 26, Department of Registration and Education, Urbana, Illinois. 67 pages. 1955*

Selected Methods for Pumping Analysis. BY JACK BRUIN AND H. E. HUDSON, JR. *Report of Investigation No. 26, Department of Registration and Education, Urbana, Illinois. 54 pages. 1955*

Dr. Robert M. Salter, SCSA Second Vice-President, Dies



Dr. Robert M. Salter, former Chief of the Soil Conservation Service, died on September 13 after a year of illness. Since November 1953, he had been Chief of the Soil and Water Conservation Research Branch of the Agricultural Research Service. He was serving as Second Vice-President of the Soil Conservation Society of America at the time of his death.

Dr. Salter was one of the Nation's outstanding scientific leaders in soil conservation and crop management. He devoted a lifetime to research, teaching, and administrative work in soil science and agronomy. His contribution to increase and sustain the productivity of the nation's soil resources are widely known. One of his biggest contributions was the development of the "package" approach to soil management in which all known factors bearing on high yields were brought together. He emphasized the need for integrated application of new scientific developments to capitalize on their interactions.

Dr. Salter was born in 1892, at Huntington, Indiana, moving at an early age to northwestern Ohio where he attended public schools and then entered Ohio State University. He majored in agronomy and was accorded a Master's degree for his work in agricultural chemistry. He later received an Honorary Doctor of Science degree from Rutgers University.

His first post in the field of science was as instructor of agricultural chemistry, at Ohio State University, 1914-1915. He went to the West Virginia Agricultural Experiment Station in 1915 to become Assistant Soil Chemist, then Soil Chemist and Professor of Soils, and, in 1919, Agronomist and Professor of Agronomy.

In 1921 he returned to Ohio State University where he spent the following twenty years doing scientific work in connection with soils, soil management and soil fertility. From 1921 to 1924, Dr. Salter was in charge of the agronomy extension program for the Ohio Extension Service. He became Chief of Agronomy, Ohio Agricultural Experiment Station in 1925; Chairman of the Department of Agronomy, Ohio State University, in charge of both soils and crops, in 1929; and Associate Director of the Ohio Agricultural Experiment Station, in 1940.

While in Ohio, Dr. Salter directed all the soil research in that state, and from the beginning of the national soil conservation program he cooperated closely with the U. S. Department of Agriculture in planning conservation projects. This included the establishment of the first erosion experiment station in the United States and the initial soil conservation demonstrations. During much of this time he held an official position as collaborator with the Soil Conservation Service of the U. S. Department of Agriculture. He has been a strong supporter of soil conservation districts, since their beginning in 1937.

Dr. Salter's work in Ohio included fundamental studies on soil deterioration and soil improvement. His research was instrumental in the development of the soil productivity indices now used in measuring soil deterioration in Ohio and other states.

Dr. Salter left Ohio in 1940 to become Director of the North Carolina Agricultural Experiment Station, but the next year he was called to Washington, D. C., to become Chief of the Division of Soil and Fertilizer Investigation, Bureau of Plant Industry, United States Department of Agriculture.

In 1942 he was appointed Chief of the Bureau of Plant Industry, Soils, and Agricultural Engineering. In this position he played an important role in bringing about better understanding of the effects of cropping on inherent soil productivity. He held this post until 1951 when he became Chief of the Soil Conservation Service.

As an agronomist and soil scientist, Dr. Salter's attention centered largely on soil management. For many years he was Chairman of the National Joint Committee on Fertilizer Application. As a result of research stimulated by this body, there has been complete redesigning of farm machinery in this field. Particularly outstanding had been Dr. Salter's work in the use of combinations of limestone, manure, fertilizers and crop rotations for building up soil productivity to sustain high crop yields.

Dr. Salter was a Fellow of the American Society of Agronomy, of which he was President in 1936. He was also a Fellow of the American Association for the Advancement of Science and served as Chairman of the agricultural section of that association in 1938. He was a member of both the National Research Council and the Soil Science Society of America.

Field Notes

Outstanding Journal Articles for 1955

The selection of this year's outstanding JOURNAL articles was made by a committee consisting of Ben Osborn, Gustav Swanson, Wellington Brink, Washington, D. C., Phillip Allan, Ithaca, New York and Firman E. Bear, New Brunswick, New Jersey. Each article was judged on the basis of subject matter, originality, authority, form and presentation. The winning articles are:

First

Estimations of Wind Erodibility of Field Surfaces
W. S. CHEPIL AND WOODRUFF

Second

Land Classification as a Guide to Production Adjustment Programs.
CLAY H. STACKHOUSE AND OTHERS

Third

Soil Erosion Survey of Latin America
DR. MARK BALDWIN AND PETER M. STERN

Honorable Mention

Humid Area Irrigation
TYLER H. QUACKENBUSH

Landlord-Tenant Cooperation Gets Conservation on the Land
JAMES J. WALLACE

"Grasses and legumes make a salad bowl out of a dust bowl."

Watershed Congress Scheduled for Washington, D. C.

Final plans for a second National Watershed Congress to focus public attention on the merit of upstream flood prevention through soil and water conservation, forestry, and small dams, were completed last month by representatives of agriculture, industry, labor and government. The Congress will be held in Washington, D. C., December 5-6 at the Hotel Statler.

A major purpose of the second gathering of national conservation, business, and labor leaders will be to appraise progress made under the Hope-Aiken law, enacted by the 83rd Congress, which provides for federal cooperation with states and local subdivisions of government in planning and executing watershed treatment programs. Subjects to be covered by the Congress include soil and water conservation, forest and range protection and management, recreation, reclamation, drainage, municipal and industrial water supplies, flood prevention, wildlife betterment, and stream pollution.

North American Wildlife Conference For 1956 To Be Held in New Orleans

The stake of the United States, Canada, and Mexico in the restoration and management of their renewable natural resources will be emphasized at the 21st North American Wildlife Conference which will be held in New Orleans, Louisiana, next March under the sponsorship of the Wildlife Management Institute. Attention will be focused on the most urgent resource problems facing North America today.

No phase of the conservation and management of natural resources will be omitted from the broad program, which will include discussions by leading international figures on subjects ranging from the basic resources of soil and water to the management of their living products. Wise use of all renewable natural resources will be stressed in the nine sessions of the three-day meeting.

The Conference program is being formulated around the central theme:

"Pulling Together For Conservation"

Approximately 60 papers will be selected for presentation during the sessions that will be held on March 5, 6, and 7, 1956 in the Jung Hotel, one of New Orleans' best

equipped hotels. All papers and the recorded discussions from the floor will be published by the Institute, as formerly, in the printed Transactions of the Conference.

In The News

Dr. A. L. Hafenrichter, who has been in the service of the United States Department of Agriculture for almost a quarter century, was honored at the Davis, California, sessions of the American Society of Agronomy when he was elected a Fellow.

He has been plant materials technician *(Western)* for the Soil Conservation Service since 1954 and is stationed at Portland, Oregon. Previously, from 1934, he was in charge of Soil Conservation Service nurseries in the Pacific coast region.

Dr. Hafenrichter entered the department in 1923 for three years of summer work after he was graduated from Northwestern College. Later he earned his Ph.D., at the University of Illinois. Starting in 1926 he was a member of the faculty at Baker University and Carnegie Institution of Washington, D. C., for four years and at the State College of Washington for a like period. Then he entered the United States Department of Interior for two years work in the Soil Erosion Service before returning to USDA to begin his Pacific coast work. He has authored more than 30 publications and is a national expert on the selection and increase of introduced and adapted grasses for the improvement of ranges, pastures and meadows in the northwest.

William F. Watkins, agriculturist with the Eastern Fertilizer Division of Olin Mathieson Chemical Corporation, has been named agronomist for the Great Lakes sales district with headquarters at Lafayette, Indiana.

In his new position Mr. Watkins will provide advisory and research services on agronomy in connection with the sale of Olin Mathieson's Ammo-Phos high analysis fertilizers, pesticides, anhydrous ammonia and irrigation in the states of Ohio, Illinois, Michigan, Indiana, Wisconsin, and Kentucky.

Clare W. Hendee, regional forester for the California region since 1951, has been named an assistant chief of the Forest Service. He succeeds Earl W. Loveridge, who recently was named agricultural attache at Bogota, Colombia, and will be succeeded by Charles A. Connaughton, now regional forester for the 11 southern states.

In his new position Mr. Hendee will direct and coordinate administrative operations, finances, personnel management, organizations, civil defense, communications.

Sport Fishing Institute announces the appointment of **George S. Fichter** as Assistant Executive Vice-President. Fichter recently resigned as Editor of THE FISHERMAN magazine, which he helped start. Besides being Editor for five years, he served on the Board of Directors and acted as a Vice-President of Fisherman Press, Inc. He edited the widely acclaimed *Fisherman's Handbook.*

Clint Davis, Director of the Smokey Bear forest fire prevention campaign, has been named chief of the Forest Service's Division of Information and Education. He succeeds Dana Parkinson, who retired June 30 after 45 years with the Service.

Livestock Farmers May Choose Between Methods of Erosion Control

Efficient livestock production is often a "must" in making conservation farm plans pay. Plans on farms with severe erosion hazards usually call for large acreages of hay and pasture. But increasing hay and pasture does not necessarily increase farm income. This forage must be marketed through well-managed livestock to return high profits. The farmer should consider his own preferences and abilities with livestock as well as his supply of labor and capital in deciding which livestock enterprise is best for his farm.

Farmers on sloping land can choose between two methods of erosion control: (1) keep a high proportion of land in hay and pasture crops and (2) use terraces, strip cropping, and contouring with a lower proportion of land in hay and pasture. Livestock farmers may choose the first alternative because they have a market for their forage crops, but grain farmers should rely on terracing and contouring as much as possible. A 1954 study showed that contour farming might increase returns $5.45 per acre by allowing a more intensive rotation while holding soil losses to a minimum. Strip cropping would increase returns by $6.66 and terracing by $10 an acre.

—W. H. HENEBERRY and E. L. SAUER, *Department of Agricultural Economics, University of Illinois, Urbana, Illinois.*

Oregon Modernizes Its Water Laws

Approved this year are two acts which should go far towards assuring orderly use and development of Oregon's water wealth. *Chapter 707* recognizes the vital concern of the state in the proper utilization and control of its water resources by establishing a policy of coordinated multiple use of surface and ground waters, and creating a single state agency to administer it. It authorizes intensive inventories of present water resources to determine their character, distribution and uses, and for studies of existing and future needs; it provides for a state-wide multiple-use program to insure the best possible disposition of water supplies in the public interest; it lists recreation, fisheries and wildlife, and pollution abatement as among the major beneficial uses of water and requires

that these uses be respected in planning reservoir construction, drainage, and reclamation projects. ("The fishery resource . . . is an important economic and recreational asset. In the planning and construction of impoundment structures and milldams and other artificial obstructions, due regard shall be given to means and methods for its protection.") And it recognizes the desirability of the watershed approach to better assure that balanced programs shall be developed.

Chapter 708 specifically relates to the control and rights of appropriation of ground waters and their use. *Among its purposes are the assurance of adequate and safe supplies for human consumption, their conservation for business, industrial, recreational, and other beneficial uses, the determination and maintenance of "reasonably stable" ground water levels, and the prevention of pollution and waste.*

Responsibility for administration of these acts is vested in a State Water Resources Board, functions of which include the conduct of studies and hearings, and the promulgation and enforcement of rules and regulations as required to minimize conflicting or damaging uses and to guide the development of the water resources into beneficial channels. Chief administrative officer is the State Engineer who will serve the board in addition to the performance of his other duties.

—BERNARD FRANK, *Washington, D. C.*

Sharing Fertility Costs on Rented Land in Proportion to Returns

A basic principle in share-renting farmland is to share costs in the same proportion as returns. If the rent is one-half of the crop, then each party should pay or contribute one-half of the costs.

Can this principle be applied to the question of who should pay for limestone, rock phosphate and annual fertilizers? Yes and no! The principle applies to the total farm business, but it may not apply to each item of inputs. The owners normally contribute all of the land and fixed improvements; the tenant contributes the labor, machinery, equipment and most of the operating costs. And on most farms these inputs by the tenant will be equal in value or proportional in value to the owner's real estate contribution.

Limestone and rock phosphate applied to the soil have the characteristics of fixed improvements—they are attached to the soil, have a relatively long life, are not movable, etc. These characteristics, and the fact that these elements are already present in varying amounts from field to field, suggest that the owner should assume these costs as part of his real estate contribution. To maintain the total balance of contributions, the tenant can assume the total cost of combining or other harvesting costs in which many owners now share because their real estate contribution does not fully offset the tenant's capital and labor inputs. Letting the limestone and rock phosphate offset such costs as combining simplifies the financial involvements of tenant and landlord. It eliminates keeping track of tenant equities in these fertility items or of granting reimbursement agreements on them.

What about annual fertilizers? The basic principle of sharing costs in proportion to returns certainly applies to annual fertilizer materials, but tenants ask about their labor and equipment costs in applying these materials. Here again the best solution may be the simplest arrangement. The tenant usually contributes labor and equipment, and there is no point in distinguishing between labor on fertilizer and labor on any other farm task. However, these added inputs associated with fertilizer use indicate that the tenant's total contributions have tended to increase more than the owner's in the last 10 to 15 years. Not only have operating capital inputs (largely supplied by the tenant) increased greatly, but the savings in labor made possible by greater mechanization have been partly offset by the increases in the price of labor. For example, labor rates have increased approximately one and one-half times as much as the increase in the price of land from the 1935-39 level. Some tenants prefer custom applications of fertilizer materials because their landlords will thus share in the cost of making the applications.

Some owners furnish a part or all of the fertilizer drill, but it is not practical for them to share in the ownership of fertilizer attachments that fit only the particular kind of planter or cultivator the tenant happens to have. A simpler, and perhaps better, solution is to let the tenant furnish the equipment and to have the owner make his contribution in some other form.

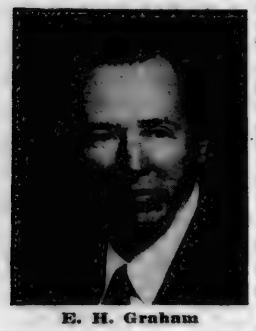
There are other questions which we cannot answer here. The answers to them, as well as the answers we have suggested, must consider the balance of total work equally well, but in the long run the ones that simplify the lease agreement may be the most acceptable. Sharing in the cost, however, usually also confers a share in the managerial control. In an effort to simplify their leases, owners and tenants should not overlook the importance of retaining a share in the cost of items they wish to control. Fertilizer is certainly one of them. Furthermore, sharing fertilizer costs in the same proportion as returns means that the point of most profitable use will be the same for both owner and tenant. Therefore, if both are motivated by a desire to maximize their returns, there should be no trouble in deciding how much fertilizer to use.

—F. J. REISS, *Department of Agricultural Economics, University of Illinois, Urbana, Illinois.*

News Notes

Graham Elected President For 1956

E. H. Graham of Falls Church, Virginia, was elected president of the *Society* succeeding Austin L. Patrick in the election which is annually conducted by mail ballot. Graham is Head of the Plant Technology Division of the Soil Conservation Service with offices in the South Agriculture Building, U.S.D.A., Washington, D. C. He is a native of Pennsylvania and a graduate of the University of Pittsburgh where he received his Ph.D. in Plant Taxonomy and Ecology.



E. H. Graham

Graham is a charter member of the Washington, D. C. Chapter and did some of the original work on the *Society's* JOURNAL OF SOIL AND WATER CONSERVATION. He has served continuously on the editorial board of the JOURNAL. He has served for three years as a vice president of the *Society*. In 1949 he was chairman of the annual meeting program committee and for a number of years served as chairman of the technical committees. He was awarded the Degree of Fellow in 1952.

The *Society's* new president has traveled extensively in the United States, Mexico, West Indies and South America. In 1954 he spent the summer in North Africa and Europe studying land use problems. While in Europe he represented the *Society* at the International Botanical Congress in Paris and the General Assembly of the International Union for the Protection of Nature at Copenhagen. Again in 1955 he spent considerable time in England.

President-elect Graham is married and his lovely wife, Mary, has attended several *Society* meetings. She is a student in her own right and has assisted her husband with his writings and collections.

J. S. Russell

First vice president for 1956 is J. S. Russell, Farm Editor of the Register and Tribune, Des Moines, Iowa. He is a graduate of Grinnell College and farmed for several years prior to military service in 1918. Following the war he entered the newspaper field and accepted his present position in 1925. During World

(*Continued on page* 312)

Pictorial Review of Annual Meeting— 800 in Attendance

National convention pictures are shown on the next page. The Tenth Annual Meeting of the Soil Conservation Society of America, held on the grounds of the American Baptist Assembly, Green Lake, Wisconsin, was the largest in Society history with 700 registered and over 850 in attendance. The scenes in the pictures are as follows: (1) Exhibit by National Agriculture Supply Company, Fort Atkinson, Wisconsin. (2) Ladies registration desk where they received momentos of the convention. (3) Nolan Fuqua, Duncan, Oklahoma, President of the National Association of Soil Conservation Districts, as he delivered the keynote address, "Twilight Zones." (4) *Left,* Donald A. Williams, Administrator of the Soil Conservation Service, Washington, D. C., as he discussed the convention with J. S. Russell, *right,* Farm Editor of the *Des Moines Register and Tribune*. Mr. Williams is also a council member of the Society and Mr. Russell was elected first vice president for 1956. (5) Hotel dining scene in the Roger Williams Inn where all meals were served. (6) Green Lake County local arrangements committee, left to right: Warren Bloomquist, *District Forester;* Francis Ptacek, *County Agricultural Agent;* Wilmer Gorske, *County Supervisor of Schools;* Franklin Jahnke, *Chairman,* Green Lake County Soil Conservation District; Mrs. Earl Sandleback, Wisconsin Federation of Women's Clubs; Earl Sandleback, *Work Unit Conservationist,* Soil Conservation Service; Nancy Newman, *Home Demonstration Agent.* (7) County and state leaders barbecuing chicken under the leadership of Prof. J. B. Hayes, *Poultry Specialist,* College of Agriculture, University of Wisconsin. Professor Hayes is in foreground. (8) Mel Cohee, *former secretary* of the Society, from Milwaukee, drawing for an "early-bird" door prize. Prizes were Wisconsin products furnished by many industries of that state.

(9) Several SCSA members were in attendance from other countries. Not all are included in the picture, but those who assembled for the photographer are as follows (left to right): W. T. McGinn, Willow Bunch, Saskatchewan, Canada; E. G. Pleva, University of Western Ontario, London, Ontario, Canada; Leonard Johnson, London, Ontario, Canada; R. C. Hodges, Oakville, Ontario, Canada; W. E. Johnson, Department of Agriculture, Regina, Saskatchewan, Canada; Chao Cheng Ching, Department of Agriculture and Forestry, Taiwan; T. H. Lane, Ontario Agricultural College, Guelph, Ontario, Canada; Hoemala Harahalf, Bogor, Indonesia; H. F. Crown, Toronto, Canada, Canada; J. S. Gunaskera, Ceylon; Kamarul Zaman, Medan, Indonesia; H. M. Holm, Saskatoon, Saskatchewan, Canada.

(10) Members listening to program. In the front row nearest the camera is Dr. Firman E. Bear, Rutgers University, New Brunswick, New Jersey; next is Prof. Emil Truog, University of Wisconsin, Madison, Wisconsin; third is R. Y. Bailey, Agricultural Research Service, and a past president of the Society, Auburn, Alabama. (11) Dr. Chas. E. Kellogg, Soil Conservation Service, Washington, D. C., as he gave his paper, *"Soil Surveys and Modern Farming."* (12) Willis G. Scholl, Vice President of Allis Chalmers Manufacturing Company, as he visited with R. G. Hill, *Chairman* of Annual Meeting Program Committee. Hill is from East Lansing, Michigan. Mr. Scholl spoke on *"Partners in Soil Conservation."*

(13) Panel discussion *"How We Do Extension Work in Soil Conservation."* Left to right—Wendell Tascher, *Extension Soil Conservationist,* Washington, D. C.; Arnold Wiebusch, *Soil Conservation Agent,* Red Wing, Minnesota; Elmer J. Lund, *Extension Area Conservationist,* LeMars, Iowa; E. O. Baker, *Erosion Control Agent,* Eau Claire, Wisconsin.

(14) R. H. Musser, *left,* First President of the Society, presenting Austin L. Patrick, retiring president, with a plaque for his service during 1955. (15) A part of the large crowd enjoying a chicken barbecue in loft of what was formerly a dairy barn on the Assembly grounds.

The photographs of the convention were taken by L. G. Samuel, J. I. Case Company, Racine, Wisconsin.

Members from 37 States Attend

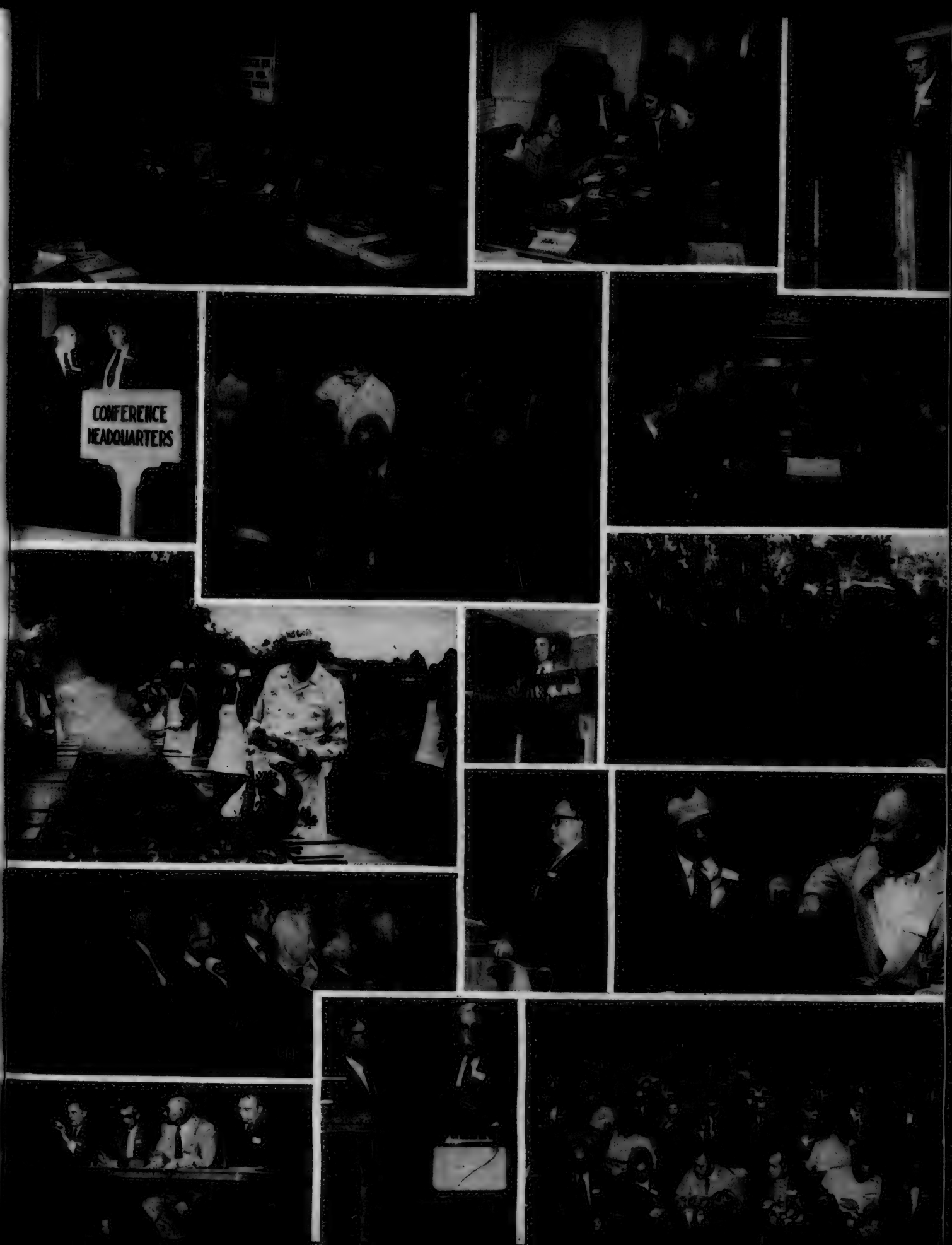
The 10th anniversary meeting of the *Soil Conservation Society of America* marked a new highlight in the progress of the organization. The largest number to date, nearly 700 including wives and families, registered for the meeting. Another 120 local people including FFA chapter and 4-H Club members, Boy Scouts and local officials attended the barbeque or certain sessions. In total 850 people were on the grounds of the American Baptist Assembly for the meeting which was held from September 12-14.

Society members from 37 states and five other countries were present Attendance honors went to Wisconsin, Illinois, Michigan, Minnesota, Kansas, Indiana, South Dakota, North Dakota, Iowa, Kentucky and West Virginia in about that order.

Late word from Franklin Jahnke, chairman of Green Lake County Soil Conservation District and Francis Ptacek, County Agricultural Agent is that the assembled group consumed 170 gallons or 1,360 pounds of milk and 154 pounds of cheese at the snack bar provided by Green Lake County officials.

Another highlight of the meeting was the barbeque provided by the industries of Wisconsin and under the direction of Professor J. B. Hayes of the Poultry Department, University of Wisconsin. Bar-

(*Continued on page* 313)


CONFERENCE
HEADQUARTERS

Walter Gumbel Resigns

One of the items on which the national council spent considerable time during the recent meeting of that body was the resignation of Walter C. Gumbel as Editor of the JOURNAL OF SOIL AND WATER CONSERVATION.

President Patrick expressed the sentiment of the council and the membership when he stated: "The *Society* is deeply indebted to Walter Gumbel for his contribution to the *Society* in developing the JOURNAL OF SOIL AND WATER CONSERVATION into a highly respected publication. It is one of the reasons why soil conservationists are interested in *Society* membership. We will never find another Walter Gumbel."

Gumbel's letter of resignation follows:

Dr. A. L. Patrick, President
Soil Conservation Society of America
Green Lake, Wisconsin

Dear Dr. Patrick:

Ten years will soon have gone by since I took over as Editor of the JOURNAL OF SOIL AND WATER CONSERVATION. During that time I have seen the JOURNAL grow and develop into a well established semi-technical publication—recognized not only by the membership, but also by others in allied fields. This in itself is a fine tribute to the *Society* and to the principles for which it stands.

Because of the progress reflected in the growth of the JOURNAL, I now find myself in an extremely difficult position. The editorial responsibilities have gradually increased to the point where I do not have sufficient time to properly handle the job. This also applies to my own position as conservationist for the Monongahela Power Company. I cannot, therefore, for personal and professional reasons, carry on indefinitely in a dual capacity without sacrificing quality of work. Both positions are extremely important and demand the best that can be given.

In view of these circumstances, I am requesting the Council to relieve me of my position as Editor as soon as suitable arrangements can be made for a replacement. I realize that *Society* finances and other related matters must be reconciled, and because of this, the transition can be gradual or immediate—depending on circumstances.

All this does not mean that I am dropping my interest in the *Society*. I would like to continue in an advisory capacity to the JOURNAL, and of course will write, review books as a principal interest and do other chores helpful to the new Editor and to the membership.

I assure you this decision was an extremely difficult one to make. My relations with the Council and the membership have not only been pleasant, but also challenging. I shall always regard these professional associations as the principal highlight of my career.

Sincerely yours,

Walter C. Gumbel
Editor

Following the council meeting and after consultation with President-Elect Graham, Dr. Patrick appointed Walter Gumbel, Firman E. Bear, Harper Simms, and H. Wayne Pritchard as a committee to investigate the possibilities open to the Society. Gumbel will serve as chairman of the committee. It was generally agreed that the organization needs the full time services of another employee but *Society* finances will need to be carefully studied. Administratively the JOURNAL and Editor are under the supervision of the Executive Secretary. For the immediate future Walter Gumbel will continue as Editor and it is expected he will continue as a Consulting Editor after being relieved of the present responsibility. Gumbel holds a full time position as conservationist for Monongahela Power Company and has edited the JOURNAL in addition during the past 10 years.

Officers

(*Continued from page* 310)

War II he served as Assistant War Food Administrator. In 1952 he made a world tour as Consultant for the Technical Cooperation Administration and in 1954 was appointed by the Department of Agriculture on Trade Commission to the Far East. He is currently a member of the Federal Reserve Board, member of Agriculture Committee, U. S. Chamber of Commerce, member of Board of Trustees Farm Foundation and chairman of the National Farm Institute.

Russell has long been active in *Society* affairs. He is a past officer of the Iowa Chapter, national treasurer for three years, chairman of the finance committee, keynote speaker at the seventh annual meeting.

R. G. Hill, Executive Secretary of the Michigan State Soil Conservation Committee and Extension Specialist in Soil Conservation at Michigan State University, East Lansing, Michigan, was elected second vice-president. Hill is a native of Michigan and a former teacher of vocational agriculture in that state. He obtained his B.S. and M.S. degrees from Michigan State University.

R. G. Hill

Hill served as treasurer of the *Society* for five years and as a member of the national council for eight years. Following his term as treasurer he served as chairman of the finance committee. He was chairman of the annual meeting program committee for the Green Lake meeting. Hill was elected as a Fellow of the *Society* in 1953.

Elected treasurer of the *Soil Conservation Society of America* for 1956 was Howard F. Barrows, Conservationist for Austin-Western Company, Aurora, Illinois. Barrows joined Austin-Western in 1911 and for many years has served as manager of sales and advertising. He is a past president of the Chicago and the National Industrial Advertising Association.

H. F. Barrows

In his daily work Barrows has encouraged private enterprise, particularly contractors and engineers, to enter soil and water conservation business. He has been active in the Society, serving as first chairman of the Northern Illinois Chapter and as chairman of the Business and Organization Relations Committee since 1950. This committee was instrumental in developing and distributing "The Story of Land" and "Down the River."

Elected council member at large for a three year term was Harry M. Chambers of Oklahoma City, Oklahoma. Chambers grew up on a wheat and cotton farm near Devol, Oklahoma. He graduated from Oklahoma A & M College in 1922 and taught vocational agriculture for 13 years, operating a 500 acre wheat farm for 9 years during this period. He joined the Soil Conservation Service in 1935. He is presently Deputy State Conservationist for Oklahoma.

Herbert A. Hopper, Lafayette, California, was elected for a three year term as council member for the western region, composed of California, Washington, Oregon, Nevada, Arizona, Idaho, Utah, Alaska and Hawaii. This is the first year of organization under the program established in 1954 to elect five of the eight council members from as many regions in the United States.

Hopper is a field man for the California State Soil Conservation Commission under the Division of Natural Resources for the state. He is a graduate of Cornell University. He is a past chairman of the San Francisco Bay Chapter, was chairman of the national program committee in 1952 and has served as chairman of the awards committee since that time. His office address is 203 State Office Building No. 1, Sacramento, California and members in the western region wanting to submit suggestions for the national council or on other matters relating to Society affairs should contact him.

Austin L. Patrick, President for 1955, will serve as a member of the council for 1956 as past president and will succeed R. Y. Bailey of Auburn, Alabama. Other retiring officers include Howard R. Bissland of Orlando, Florida, as Treasurer; Roy D. Hockensmith of Washington, D. C. and Fred A. Wirt of Racine, Wisconsin, retire as council members. Robert M. Salter, second vice-president for 1955, passed away during September.

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Annual Meeting

(*Continued from page* 310)

beque pits were constructed by local soil conservation district officials, were about 50 feet in length, and next to one of the very large buildings, formerly a dairy barn, on the grounds. Seven hundred were served within a short period of time.

The Wisconsin Hospitality Night program arranged by the Wisconsin Chapter and with Arthur Kurtz of the Wisconsin Department of Agriculture serving as master of ceremonies provided an interesting evening of entertainment following a short business meeting of the Society. An outstanding group, The Cardinal Quartet, past national winners of Barbershop Quartets, appeared on the program. Dean R. K. Froker, College of Agriculture, University of Wisconsin brought greeting to those in attendance. Later the group adjourned to the Roger Williams Inn where refreshments were served. Miss Schafer of the Wisconsin Department of Agriculture had arranged for beautiful frozen decorations.

Ladies attending the convention were greeted by a hospitality committee and provided with a "loot bag" which was easily filled before they left for home. Mrs. Earle Sandleback and her committee made it an enjoyable occasion for the ladies.

At the general sessions, door prizes were provided by Wisconsin industries and business firms. Art Jorgenson and his committee assisted by Peder Lund, Mel Cohee and others kept the crowd continually in suspense.

Other committees arranged for publicity, pictures, broadcasts, exhibits, maps and tours. The list of those who spent time and effort is a long one. The general arrangements were under the direction of I. O. Hembre, Chairman of the Wisconsin Chapter.

The program for the meeting was arranged by a committee, chairman of which was R. G. Hill of East Lansing, Michigan. No attempt will be made her to review the papers as many of them will be published in the JOURNAL OF SOIL AND WATER CONSERVATION and many are available in mimeograph form as indicated elsewhere in this section of the JOURNAL.

Chapter News Condensed

Manhattan Chapter met on October 7, 1955, at Clay Center Country Club. Congressman William Avery spoke as did Howard Hughes, Work Unit Conservationist from Riley District. Hughes reported on annual meeting at Green Lake . . . Oklahoma chapters of the Society established a good planting of native grasses, legumes and forages on the State Fair Grounds and which was center of interest during recent state fair according to Stewart Jessee . . . San Francisco Bay Chapter had meeting on October 24 in Forestry Building, University of California. "Land Conservation and Development in Italy" by Dr. David Weeks and report on national meeting comprised the program . . . Northern Illinois Chapter met at Kankakee on November 4. Dr. John H. Garland of the Geography Department of University of Illinois was the speaker on "The American Midwest." His new book on the subject was released during October. President Patrick attended. . . .

The West Tennessee Chapter, a new chapter, met on October 14 at Reelfoot Lake. The tour of the Wildlife Refuge was conducted by Preston Lane of the Fish and Wildlife Service. Damon R. Headon spoke on "Realfoot Lake and It's Future." Nash Buckingham, Memphis sports writer, spoke on "Fresh-Water Artificial Lakes and Their Recreational Uses and Possibilities." The Custer Chapter met at Bismark, North Dakota on July 20 and 80 in attendance heard Dr. Charles E. Kellogg of the Soil Conservation Service and saw slides of "The Belgian Congo" . . . Later in the summer the chapter also sponsored a successful picnic for members and families . . . Border chapter met on Masonic Island of Lake Metigoshe in North Dakota on August 13 for a picnic. Plans were made to meet with other North Dakota Chapters in November.

Washington, D. C., Chapter held its first meeting of the fall season, September 7, with H. L. Manwaring, Deputy Administrator of Production, Commodity Stabilization Service, as speaker. He spoke about the relationship of production adjustment, in agriculture, to soil and water conservation.

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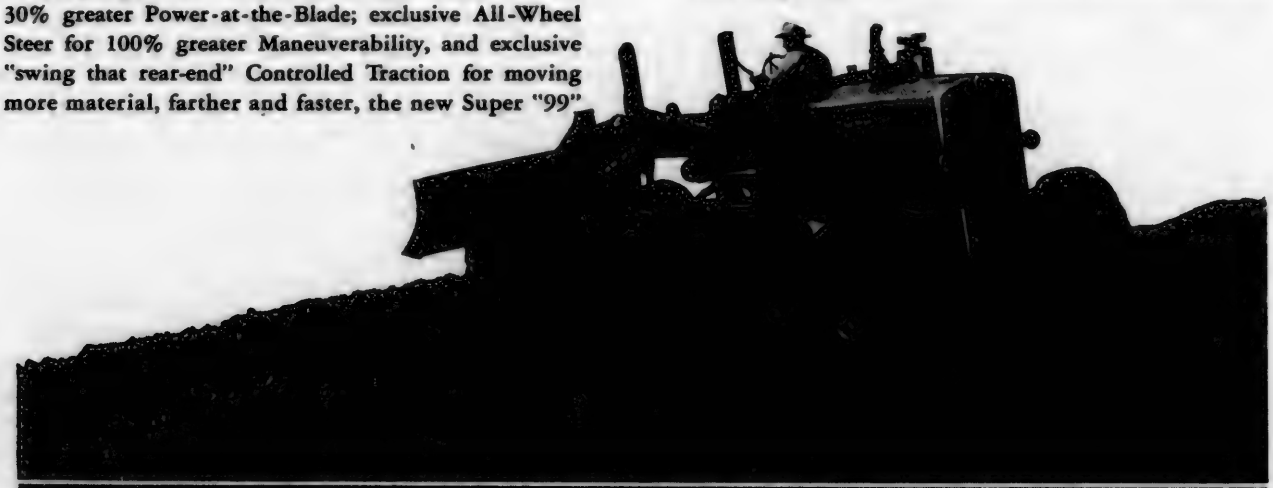

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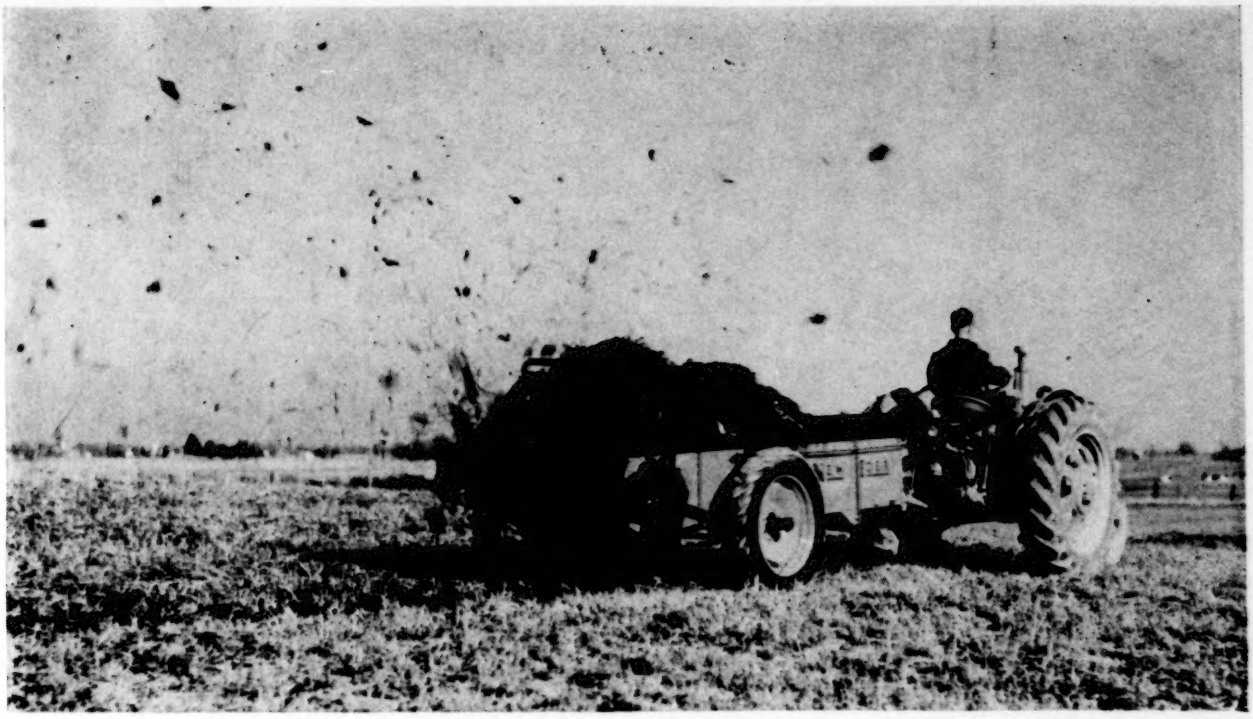

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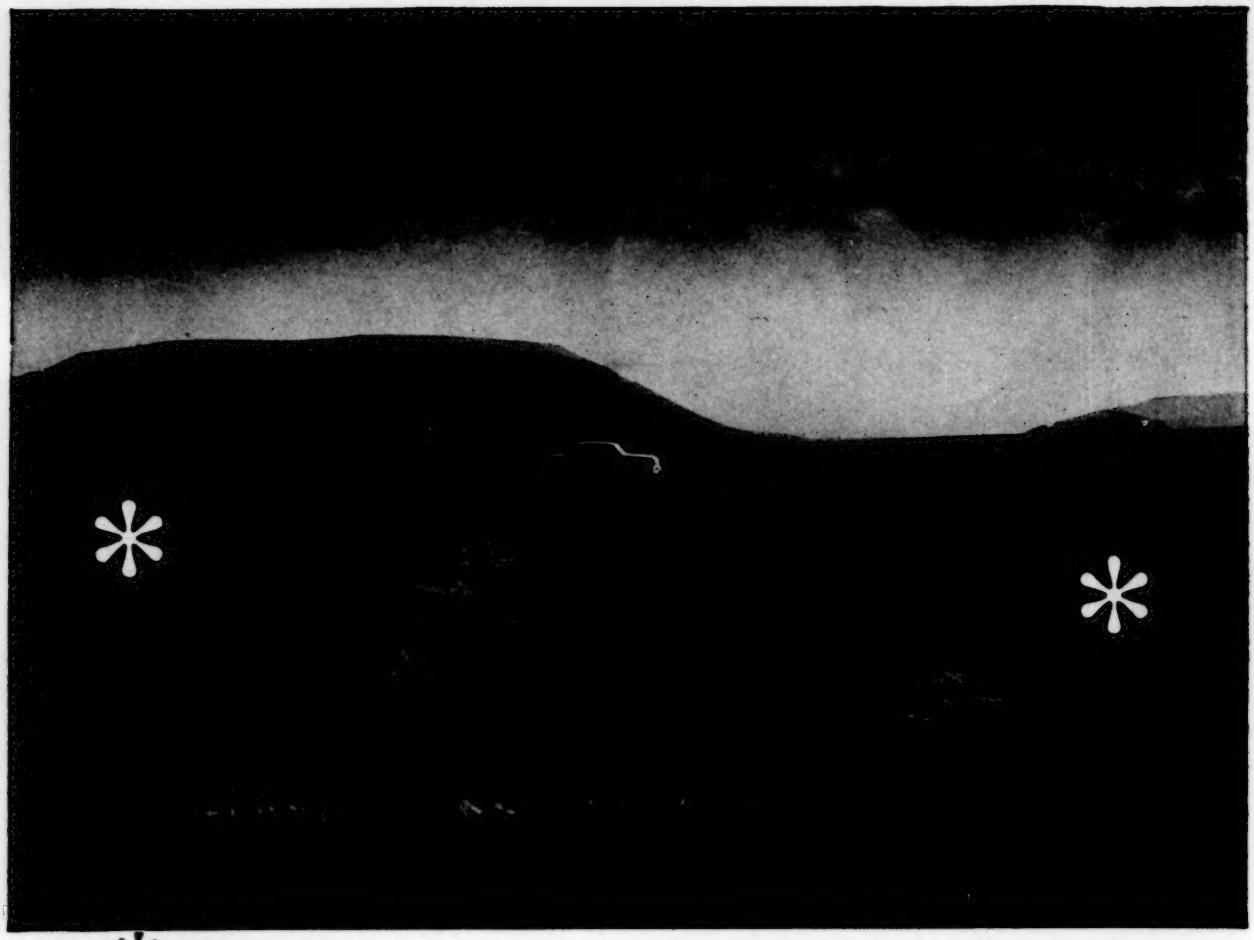

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2. History: Alfalfa sown in 1948-1949 season. Limestone applied at rate of 1 ton per acre at time of sowing. Superphosphate applied twice before test without noticeable effect.
3. Soil type: Kauru silt loam, a poor slowly weathering soil of sandstone origin.
4. Soil conditions: pH 5.9. Exchangeable calcium high, potash very high, phosphate adequate, limestone required in maintenance quantities only. Available molybdenum (Griggs method) 0.09 ppm.
5. Test conditions: Sodium molybdate in water solution sprayed on side areas in December, 1951, at rate of 2½ ounces an acre. Side areas resprayed at same rate August, 1953.
6. Results: Above photograph taken October 30, 1953 shows increase in yield estimated at 500%. Pale center area was not sprayed.

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CLIMAX MOLYBDENUM